HOW MAN BECAME A GIANT

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HOW MAN BECAME A GIANT

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TO BORIS

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FOREWORD

About the evolution of man and the growth of civilization, there are many books. But most of those written for grown-ups are by specialists for specialists, and most of those for young people tend to insult the intelligence of their prospective audience. Yet manifestly, the average grown-up is entitled to an account that does not cloud his understanding by a parade of highly specialized knowledge, and the average youth, to one that will grant him a mental age of more than five. That it required a man and a woman reared in a new civilization to produce the latter is not altogether an accident, for this civilization was itself the work of the young—the young in years and the young in heart. It is not strange that they should understand, better than we, how strong is the young person's urge for essentials, for the proper intermingling of concrete detail with honest explanation and proper theory, and how contemptuous is his attitude toward all subterfuge and evasion.

It is this understanding of the psychology of young people that is the chief characteristic of "How Man Became a Giant." In our civilization children have been taught for generations that giants existed only in the dim dawn of history, if they existed at all. It will come as a revelation to them—if

indeed they have not always suspected it—that this is not so; that giants are real beings, that they slowly developed into giants through myriads of years and by myriads of transformations and adventures, and that they themselves are incipient giants. From Ilin and Segal's book they will discover that man began as a pygmy and has only assumed his gigantic stature within the last few thousand years. How he has done this, what were the great and significant periods of his growth, what obstacles were placed in his path by nature and his fellow men, all these facts are truthfully and accurately recorded here, with full appreciation of what constitutes real change and development and what price had to be paid for them.

If at times the authors seem, to specialists and grown-ups, to make the concrete too concrete and the general too general, occasionally to run ahead of the facts, these are minor defects, if indeed they are defects. All that really matters is that an author depict human evolution in a truthful fashion, without those half-truths and evasions that so easily creep into academic and professional accounts. Girls and boys, and those fortunate adults who possess a child's sense of the realities, insist that the arrangement of facts on this fascinating subject carry conviction, that they give a clear and unbiased picture of how man has arrived at his present estate, of the powers of darkness and opposition that confronted him in the past, how he met them and how he must meet those of today and tomorrow.

All this and more they will find here. We older people can only envy the young who have been given such an opportunity, and congratulate the new civilization that could produce authors capable of writing such a book.

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INTRODUCTION

The Man-Giant

There's a giant in the world.

He has hands that can lift a locomotive without the least effort.

He has feet that can travel thousands of miles in a single day.

He has wings that can carry him up above the clouds, higher than a bird can fly.

He has such fins that he can swim on top of the water and under the water better than any fish.

He has eyes that can see the invisible, ears that can hear what people are saying on the other side of the world.

He's so strong that he can go right through mountains and stop head-long waterfalls in midstream.

He makes the world over to suit himself; plants forests, unites seas, waters deserts.

Who is this giant?

This giant is man.

How did man get to be a giant?

That's what we're going to tell you about in our book.

PART ONE

HOW MAN GOT TO BE A GIANT

CHAPTER I

IN AN INVISIBLE CAGE

There was a time when man was not a giant. He was a dwarf. He was not the master of the world about him. He was its obedient slave.

He was as powerless over nature, had as little freedom as any wild animal or bird.

"What," you say, "aren't wild animals and birds free? Isn't a wild squirrel hopping about from one tree to another in the woods free? He's not in any cage!"

"And do you think a woodpecker that pecks away at any birch tree he fancies is tied to that tree?"

It does seem ridiculous on the face of it. For it's certainly true that nobody ever saw a wild woodpecker tied to a tree or a wild squirrel shut in a cage.

No, nobody ever did see that and nobody ever will, because the cage and the chain are both invisible.

There was a time when man, too, lived in just such an invisible cage and was bound by just such

an invisible chain. If we want to find out how he succeeded in breaking the chain and getting out of the cage, we'll have to go to the woods and see how our relatives there, who are still prisoners, live.

So we must begin this book about man with a walk in the woods and a talk about wild animals and birds.

"Free as a Bird"

You've often heard people talk about being "free as a bird." But do you suppose a woodpecker is free? If he were a "free" bird he could fly anywhere he happened to take a notion and live wherever he pleased. And that's absolutely not the case. Just try moving a woodpecker to a treeless prairie. He'd die, for he can live only where there are trees. It's just as if he were chained to a tree by an invisible chain which he can't break.

Take another bird—the fir-tree crossbill, for instance. Like the woodpecker, he, too, has to live in the woods. But he can't live in just any wood he pleases. He has to live in a fir wood. And his cousin, the pine-tree crossbill, can live only in a pine forest and nowhere else.

It's just as if the fir wood where the fir-tree crossbill lives were covered with an invisible cage that kept him from getting out. And the pine-tree crossbill never leaves the pine forest, either, as if there were a high, invisible wall all around it which he couldn't fly over or get through.

A Stroll in the Woods

Whenever you take a walk in the woods you keep passing through these invisible walls. And when you climb a tree your head goes right through invisible ceilings. Every forest is divided up into different pens and cages like a zoo even though you can't see them.

As you walk through a forest you can't help noticing that it changes. You're among firs for a while, then among pines. And you'll notice that there are two kinds of pine trees, low ones and tall ones.

In one place you'll be walking on white deer moss, in another in tall grass, and then again on moss, only this time not white but green.

For the summer vacationist this is all just woods. But ask a forester and he'll tell you there are really four forests here, not just one. In the damp lowlands are silver firs with thick tops like soft feather beds. Farther up, on the sandy slopes, are the groves of green mossed pines, where there are lots of bilberry and huckleberry bushes. Still higher up, on the sandy summits, are the white mossed pines, and in damp spots here are grassy meadows again.

Without knowing it you passed through three walls which separated four small worlds. You went through four different cages each containing its prisoners.

If there were signs hanging on the trees in the forest, like the signs you see in a zoo, giving the

names of the different animals, you would find on the sign hanging in the fir wood the names: Fir-tree Crossbill, Tri-dactylus Woodpecker, Bullfinch, Chaffinch, Wren, Squirrel, Marten, and Wood Mouse.

On the sign hanging in the pine woods you would find quite other names. There would be: Whippoorwill, Bobolink, Striped Woodpecker, Flycatcher, Yellow-breasted Pewee, Thrush.

The birch woods have their prisoners, too, and you will never find them in a fir wood or a pine grove. For instance, the birch grouse. This bird's name gives its address. You can see from its name that the birch grouse can live only in a birch grove, in a leafy wood.

Every wood is like a cage. And these larger cages are divided up into smaller pens and cells. For example, in every forest there are several different stories, just as there are in a big apartment house. There are two-story woods and three-story woods, and even seven-story woods.

Pine woods are two, sometimes three stories high. On the first floor are moss and grass. Bushes and shrubs live in the second story, the pines themselves in the third.

An oak wood is seven stories high. The highest floor, the seventh, is the tops of the oaks, ashes, maples, and lindens. Their wavy crowns form a roof for the woods, green in summer, multicoloured in the fall. Lower down, about the middle of the oak trees, are the tops of the mountain

ashes and the wild apple and pear trees. This is the sixth story.

Next, in the fifth story are the matted branches and leaves of the shrubs—hazel bushes, hawthorns, prickwood. Below the bushes are the grass and flowers. But they are divided into several stories: highest up, on the fourth floor, are the bluebells. In the third story, among the ferns, bloom lilies-of-the-valley and cowwheat. Violets and strawberries live in the second story, and the first, or ground floor, is covered with leafy mosses.

Still lower down, under the ground floor, there is a cellar. Here are the roots of the trees and shrubs.

Every one of these floors has its own tenants—wild animals and birds. High up among the topmost branches the hawk has his nest. The woodpecker lives a little lower down in the trunk of the oak. On the fifth floor, down among the bushes, are the noisiest tenants of all. They fill the forest with their whistling and singing: wrens, redstarts.. ..The first floor tenant, the woodcock, roams about on the ground. Down in the cellar field mice dig their underground tunnels and holes.

There are all kinds of apartments in this huge apartment house. Those on the top floor are warm, dry, and light. Those on the ground floor are dark, wet, and cold. There are cool apartments, good only for summer, and warm ones which can be lived in the year round.

A hole dug in the ground is a winter apartment. Try taking the temperature in a hole four or five

feet down on a freezing winter day. You will find that when it is 0° F. at the surface, the temperature down in the hole is about 46° F. And without steam heat too!

In the trunk of the oak it is much colder. An animal living there in winter would freeze. That makes it a nice place in the summer, especially for owls and bats who are on night shifts and like to spend their days dozing somewhere in a dark, shady nook.

People often change their apartments and move about from one house to another, from one floor to another. But in the woods the tenants of one floor can't change apartments with the tenants on another floor. For, you see, in the woods they are not tenants, they are prisoners. Their living quarters are not apartments, they are cells.

The woodcock who lives on the first floor, cannot change his damp, dark quarters for the dry sunny penthouse on the roof. The hawk couldn't possibly live on the ground floor, even if he took such a crazy notion into his head.

What's really at the bottom of all this? What kind of unseen walls and ceilings are these that divide the woods into cages and cells? What is it makes prisoners of wild animals and birds living at liberty? What keeps the fir-tree crossbill in the fir wood, the pine-tree crossbill in the pine grove, the woodcock on the ground floor and the wood-pecker and the hawk in the upper stories?

A Visit to the Fir-Tree Crossbill

Let's go make a visit to the fir-tree crossbill and see how he lives and how he spends his days. The best time to visit him will be at breakfast or dinner, though it is hard to say when breakfast ends for a crossbill and when dinner begins. He spends a lot more time eating than any of us do.

A crossbill doesn't use a knife or fork at dinner. His tableware consists of a pair of pliers and he's very clever at using these pliers to open cones and gets the nuts out of them. The crossbill is never without his table tool, not even when he's asleep, for the very simple reason that his own beak serves him as his pliers. This beak is as fitted to get at the nuts in a fir cone as a nutcracker is fitted to the cracking of a nut, or a corkscrew to getting out a stopper. The crossbill himself, during the course of thousands of years, adapted his own bill to suit the conditions of the fir wood, so that he could get at the nuts in the fir cone. He was so successful in adapting himself that now not only is the fir necessary to the crossbill, but the fir tree needs the services of the crossbill. For, as he is getting nuts for his dinner, he scatters a lot of them about on the ground and thus sows fir trees to provide supplies for future generations of crossbills. This is what makes the tie between the fir tree and crossbill so strong.

The fir-tree crossbill can't even change homes with his nearest relative, the pine-tree crossbill. For the beak of the fir-tree crossbill is an instrument

precisely suited to opening fir cones, but it is not strong enough to open the hard pine cones. Getting the pine nuts out of a pine cone is the speciality of the pine-tree crossbill.

This is what keeps the fir-tree crossbill in the fir wood and the pine-tree crossbill in the pine grove. It was not from his own choice but from necessity that the fir-tree crossbill became a prisoner and ally of the fir wood.

He has no freedom but, in return, he is in no danger of starving. There is never any shortage of fir cones, winter or summer. The crossbill never leaves his fir tree even in winter, for all winter long there are plenty of nuts in the fir cones to supply him with food.

Forest Prisoners

If we made visits to the other prisoners in the forest, we would find that every one of them is tied to his own particular forest, kept on his own particular floor in the forest by a chain which it is not easy to break.

The woodcock, for instance, lives on the ground floor because he finds his food in the cellar. His long beak is specially suited to get earth worms from underground. He wouldn't know what to do in a tree. That's why you never see a woodcock sitting in a tree top. And a woodpecker wouldn't know what to do on the ground. For whole days at a time he keeps going round and round the trunk of some fir or birch tree. What is he pecking at there; what is it he is looking for?

If you should skin off the bark of a fir tree you would find little twisting tracks gnawed round the trunk, right under the bark. These were made by a little worm, a parasite of the fir, the fir weevil. Every track ends in a little cradle-like hole and in this cradle the larva of the weevil changes first into a pupa then into a weevil. This weevil is adapted to the fir tree and the woodpecker is adapted to the weevil. The woodpecker has a long, limber tongue that can get into these tiny hidden holes, no matter how they are tucked away out of sight, and lick out the larva of the weevil.

Here we have a three-linked chain: fir tree—weevil—woodpecker. Scientists call such chains "food chains." All the prisoners of the forest are linked together by such food chains.

Take the wood marten, for instance. Why does he live in the forest? Because he hunts another forest dweller, the squirrel. The squirrel lives in the forest because that's the only place he can find the food he must have. Once some hunters opened up the stomachs of squirrels they had killed in a virgin forest to see what kind of food these squirrels ate in their forest restaurant. The menu proved to be fir-tree nuts and mushrooms. So we have another link: marten—squirrel—mushrooms—fir-tree nuts.

We might follow this chain farther. We have seen why the marten and the squirrel live in the woods. But why do mushrooms grow in the woods? We've all gathered mushrooms some time in our lives. But we haven't all asked ourselves the question:

"Why do mushrooms grow in the woods and not along the seashore?"

Mushrooms grow in the woods of necessity, just like the birds and animals we've been talking about—because they get their food in the woods. For mushrooms live on prepared foods, food that has been stored up by the plants. The earth in a forest is full of decaying bits of grass, leaves, moss. Mushrooms live on this decaying matter. That's why there is always a mouldy decaying smell in a place where mushrooms grow.

So we add another link to our chain: marten—squirrel—mushrooms—decaying vegetation. The marten doesn't eat mushrooms, but he is nevertheless linked up with them by this food chain.

The food chain is the means by which the energy of the sun, gathered up and absorbed by growing plants, is transferred from one thing to another.

But this food chain is not the only thing which holds the forest prisoners. There are other chains too. There are two chains which keep the California woodpecker a prisoner in the forest: one fastens him to the oak which provides an ample supply of acorns for his food, the other fastens him to the yellow pine. The woodpecker doesn't eat the nuts of the yellow pine but the pine is necessary to him for quite another reason. It serves him as a store-house. He stores acorns in the hollows of the pine tree trunks to supply him when there are none on the oaks.

No Admittance !

The forest world is one of the many small worlds that make up the world. There are prairies, and deserts, and mountains, and tundras, and seas, and lakes on the earth as well as forests. On every prairie, just as in every forest, there are invisible walls separating one division of the prairie from another. Every sea has several underwater floors.

On the shores of the Black Sea there are eight such floors. Only you count these floors from the top down instead of from the bottom up. The first floor, close up to where the cliffs come down to the water's edge, is the home of the sea anemones, crabs, and barnacles. Below that, in the second story down, hermit crabs roam about the sandy bottom and sultan fish bury themselves in the sand. Oysters live lower down, in the fourth story. The very lowest floor, at the bottom, is filled with a poisonous gas, sulfurated hydrogen. But even this floor is not empty. It is inhabited by bacteria which have become adapted to living in this poisonous atmosphere. What is deadly to other creatures is to them the very breath of life.

There are about a million different kinds of living creatures in the world, each living in his own little world, to which he has become adapted. Some live in the water, others on the dry land. Some can't endure the light and others don't like the darkness. Some bury themselves in burning hot sand, others can live only in a marsh. Where the sign: "No Admittance !" hangs out for some,

others find a sign reading: "Entrance Here!"

Birds flourish where fish would perish. A spot which is entirely overgrown with trees is free ground for moss—because moss loves the shade, while trees have to have light.

There are no vacant spots in the world, no spots where life has not penetrated. Where one kind of life cannot survive, another can. At the poles and at the equator, on the tops of mountains and at the bottom of the sea—everywhere there are living things whose homes are there, who could not live anywhere else.

If you should put a polar bear in a tropical jungle he would die, just as if he had been put into a Turkish bath, for he wears a fur coat he can't take off. Whereas the elephant, a native of the tropics, would freeze to death in the Arctic, for he goes around naked as if he were always just about to take a bath.

There is only one place in the world where you may see animals from every latitude, animals from the prairies and animals from the forests living within a few feet of each other. That place is a zoological garden.

In a zoo, South Africa is situated right alongside Australia. Australia is only a few steps from North America. Animals from all over the world are gathered together, but they didn't collect there of their own accord. It was man who brought them together.

And what a lot of trouble he has with his collection! Every animal has to be provided with

Our ancient tree-dwelling ancestors

surroundings as nearly like those to which he is accustomed as possible. For one a pool of water has to take the place of the ocean; another has a sandy desert twenty feet square. Then all the animals have to be fed and kept from eating one another. The polar bear has to have a cold water bath, the monkey a warm one. The lion has to get his regular portion of raw meat every day and the eagle has to have room to spread his wings. All these animals have to have the kind of surroundings they have been used to or they will die.

Well now, what kind of animal is man: a plainsman, a forest dweller, or a mountain dweller? Do we call a man who lives in the forest a "forest man," or one who lives in a swampy place a "swamp man?"

We do not!

Because the man who is living in the forest can also live in the plains, and the man who is living in the swampy land will be only too glad to move to a dry spot.

Man lives everywhere. There is hardly a spot left in the world to which he has not penetrated, hardly one single place where the "No Admittance" sign is hung out for him. The arctic explorer, Papinin, and his companions lived for nine months on a drifting ice floe. And if they had had to undertake a trip to the middle of a burning hot desert, they could have done it just as successfully.

Man has penetrated everywhere: he has climbed to the tops of most of the highest mountains, ventured to the bottom of the sea, crossed the Sahara

desert, explored the snowy wastes of the Arctic, gone down into the bowels of the earth and up into the stratosphere.

But it was not always so. It was not so in those days when man was not so free and powerful as he is now.

Meet Your Ancestors !

Millions of years ago, instead of the forests of oak and aspen and beech, such as we have today, forests were entirely different, They were filled with entirely different kinds of animals, too, and different kinds of bushes, grasses, and ferns. In these long ago forests the birch, the linden, and the ash grew right alongside the myrtle, the laurel, and the magnolia. The walnut tree was neighbour to the grapevine. Near the modest weeping willow the camphor trees flaunted their brilliant blooms. Mighty oaks seemed dwarfs beside these mammoth trees.

Carrying out our comparison of a forest with a house, we'd have to call this forest not merely a house but a regular skyscraper. The upper stories of the skyscraper were full of light and sound. Gaily coloured birds flew about among the huge brilliant blossoms, filling the air with their shrill cries, monkeys balanced on the branches and swung lightly from tree to tree.

One tribe of apes ran along the branches as if they were a bridge. The mothers, clasping their babies to their breasts, stuffed chewed-up fruits and nuts into their mouths. The older children hung

onto their mothers' legs. The old, hairy leader of the band ran lightly up the trunk of a tree. The others followed after him.

What kind of apes are these?

They're a kind you won't find in any zoological garden today. They are the species of ape from which sprang man, the chimpanzee, and the gorilla. We have met our ancient tree-dwelling ancestors.

Our forefathers lived like a woodpecker in the upper stories of the forest. These creatures, which were to develop into man, moved about among the branches of the trees as if they were bridges, galleries, and balconies hundreds of feet up in the air. The forest was their home. At night they made nests for themselves in the forks of the trees.

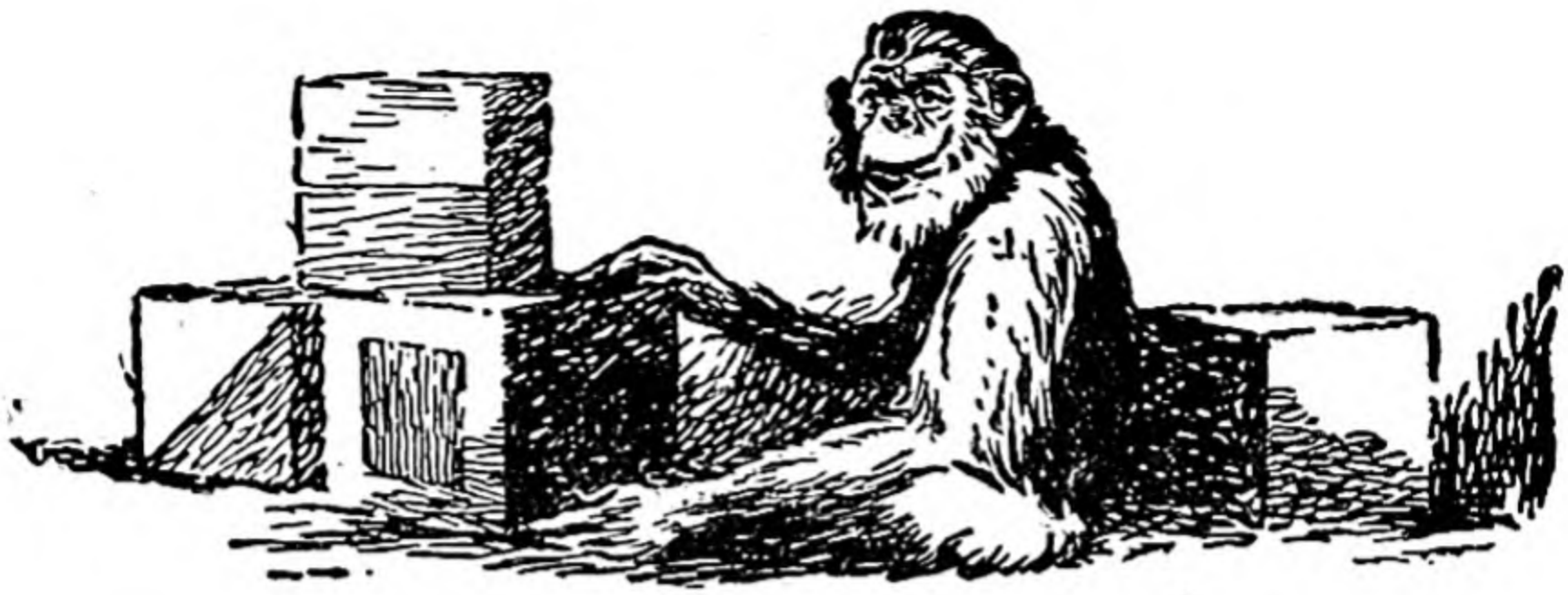
The forest was their fortress. High up among the branches they hid from their dread enemy, the saber-toothed tiger with his dagger-long tusks.

The forest was their store-house. High up among the branches were stores of fruit and nuts for them to eat.

But, in order to get along way up on the roof of the forest, they had to adapt themselves to it, get so they could grip the branches easily, run surefootedly along the tree trunks, jump from tree to tree, seize hold of fruit and pull it from the tree, crack the nuts. They had to have prehensile fingers, they had to have keen eyesight, they had to have strong teeth.

Our forefather was chained to the forest not by one chain but by at least three, and not only to the

forest but to the highest story of the forest. How did man manage to break these chains ? How did this forest animal dare venture out of his cage, go beyond the confines of the forest ?



CHAPTER II

OUR HERO AND HIS RELATIVES

The Grandmother and the Cousins of Our Hero

Authors of a few generations ago used to be very deliberate when they set out to write about the life and adventures of their hero. In the first chapters the reader would learn all about the hero and his relatives. By reading the first few pages he found out just how the hero's grandmother dressed when she was young, and what his mother dreamed about the night before she was married. Then would come detailed descriptions of the hero's first tooth, his first words, first steps, first little tricks.

After about ten chapters the hero got started in school, and by the end of the second volume he fell in love. In the third volume, after overcoming all kinds of obstacles, he was married and the novel ended with an epilogue showing the hero and his wife, their hair now beginning to turn gray, admiring the first tottering steps of their rosy-cheeked grandchild.

In this book we are going to tell about the life and adventures of man. Following the example of the worthy novelists of those days, we are going to tell about the remote ancestors of our hero, about his nearest relatives, about his first appearance on the earth and how he learned to walk, to talk, to think; about his struggles to make a living, about his sorrows and joys, his victories and defeats.

We must confess that right at the beginning we run into the most serious difficulties.

How can we describe his grandmother, that ape grandmother from whom he is a direct descendant, when for ages and ages there has been no such person in the world? We haven't any portrait of her, for the very good reason that, as you well know, apes can't draw. Only in a museum can we make any contact with those ancestors we were talking about in the preceding chapter. And even in a museum it will be impossible to find a whole one. For all that is left of them are a few bones and a couple of handfuls of teeth which have been found in different spots in Africa, Asia, and Europe.

We're used to seeing grandmothers without teeth. This is a case of the teeth without the grandmother.

At the time when man has long since come down out of the tropical forests and is standing on his feet, in the literal sense of these words, his nearest relatives—gorillas, chimpanzees, gibbons, and orang-outangs—are still wild animals in the forest. Man is a bit reluctant to think about his poor relations. He even tries, sometimes, to repudiate

his kinship. Some people consider it an insult even to allude to the fact that man and the chimpanzee had a common great-grandmother.

A few years ago there was a trial about it. A school teacher was brought into court and tried because he had dared tell his pupils about man's relationship to the ape. A number of worthy citizens appeared on the streets wearing armbands reading:

WE ARE NOT MONKEYS AND WE REFUSE
TO BE MADE MONKEYS OF!

The poor school teacher, who hadn't the remotest idea of trying to turn these donkeys into monkeys, was quite overcome by the mob of people who came to bring accusations against him. When he was being browbeaten by the threatening questions put to him by the judge, he must have thought:

"The judge must have lost his senses! Why you might just as well have a trial about the multiplication table!"

The trial was carried on with all the legal formalities. After the witnesses had given their testimony, the accused was given the last word. Then the judge gave the verdict:

1. It has been proved that there is no relationship between men and apes.

2. The accused is fined one hundred dollars.

So a Tennessee judge abolished the entire science of the origin of man as established by Darwin and other scientists.

But facts are stubborn things. They cannot be abolished by judicial decree.

We could fill our book with proofs of the relationship of man and the ape. But even without these scientific proofs this relationship is quite obvious to the most casual observer who has ever seen a chimpanzee or an orang-outang.

Our Cousins Rosa and Raphael

A few years ago, in the village of Kotushy (now called Pavlov), two chimpanzees, Rosa and Raphael, were brought to the laboratory of the scientist, Ivan Petrovich Pavlov.

People are not ordinarily very polite to their poor forest relatives when they come to visit them. The first thing they do is to put them into a cage. But this time, these guests from the African forests received the most hospitable welcome. An entire suite was put at their disposal: bedroom, dining room, bath, office, and playroom. There were two nice beds in the bedroom, with a night table at the head of each one. The dining table was covered with a white tablecloth and the cupboard shelves were well stocked with provisions.

There was nothing in their attractive suite to remind them that they were not human beings but apes. They were supplied with knives, forks, and spoons at the table. Their beds had blankets, sheets, and pillows. True, the guests did not always behave with proper decorum. At dinner they would put down their spoons and lap up their pudding from the dish. At night, instead of putting

their heads on the pillows, they would put the pillows over their heads.

But if Rosa and Raphael didn't behave exactly like people, they came close to it. Rosa, for instance, could use the keys to the cupboard as well as any housekeeper. The guard usually kept the keys in his pocket. Rosa would steal up behind him and slip her hand into his pocket. Then she would make a dash for the dining room, go straight to the cupboard and sit down on a chair in front of the glass doors of the cupboard. Behind these glass doors were tempting plates of apricots and grapes. She would carefully fit the key into the keyhole, give one quick twist and the coveted bunch of grapes was in her hand.

And Raphael! You should have seen him at his lessons. His apparatus consisted of a pail of apricots and some blocks of different sizes. These blocks were much larger than the ordinary child's playing blocks. The smallest of them was at least as high as a footstool. The pail of apricots was hung high up out of his reach. The problem was to reach it and eat the apricots.

At first Raphael was utterly unable to solve this difficult problem. Back in his forest home he had often scrambled up a tree to get at the fruit he wanted. But here the fruit was not hanging from a limb, it was dangling right up in the air out of reach. The only things in the room he could climb up on were the blocks. But even when he got on top of the very biggest block, he still couldn't reach the apricots.

In turning the blocks over and over Raphael made an accidental discovery; that if you put one block on top of another it brought you nearer to the apricots. Little by little he arrived at the point where he would make a pyramid first of three, then of four, and finally of five of the blocks. This was no easy job for him. He couldn't pile them up haphazardly. They had to be put in a certain order; the biggest on the bottom, then the next smaller, and so on down to the smallest one.

Over and over he made the mistake of trying to put the big ones on top of the smaller ones and the whole thing would totter menacingly. It looked as if the pyramid was going to come tumbling down carrying Raphael with it, but this never happened for, you see, Raphael was "as nimble as a monkey."

At last he solved the problem. He piled all seven blocks one on top of another, in order of their size, just as if they were all numbered and he had read the numbers on them.

He reached the pail at last, and there, on top of the swaying pyramid, feasted on the well-earned apricots.

What other animal would have behaved in this human way? Can you imagine a dog's building a pyramid of blocks? Yet you know a dog is a very intelligent animal.

It was simply amazing to see how much Raphael was like a person when he was at work. He would pick up a block, put it on his shoulder and, balancing it with his hand, carry it over to the pyramid.

If the block didn't fit, he would put it back on the floor and sit down on it as if he were thinking it over. After a few moments of rest he would set to work again and this time correct the mistakes he had made.

Can a Chimpanzee Be Turned into a Man?

Well then, can a chimpanzee learn to walk and talk and think and work like a human being?

This was the dream of a famous animal trainer. He took all kinds of pains to educate a chimpanzee named Mimus. Mimus proved to be a most intelligent pupil: he learned to use a spoon, to tie a napkin round his neck, to sit on a chair at the table and eat his soup without getting any on the tablecloth. He even learned to coast down hill on a sled.

But he didn't become a human being.

It is easy to see why. A chimpanzee is constructed quite differently from a human being. His hands are different. His feet and legs are different. His brain is different. His tongue is different.

Just take a look into a chimpanzee's mouth—only be careful. Chimpanzees bite hard. You will see that there isn't room inside his mouth for his tongue to move about much. And the little space there is filled up with his big teeth.

This one fact, that there isn't room in his mouth for his tongue to move about freely, makes it impossible that he should ever learn to talk. When a human being talks, his tongue has to go through the most intricate gymnastics: bend itself into a bow, quiver, press up against the roof of the

mouth, draw back to let the sound come out of the throat, and, vice versa, move forward and press against the front teeth. There has to be room for all these acrobatics and the chimpanzee has very little free space in his mouth.

It is also entirely impossible for a chimpanzee to work with his hands like a human being, for his hands are quite different from a man's hands. A chimpanzee's thumb is smaller than his little finger. It is not set off so far on the side as it is on our hands, and it is precisely the thumb that is the most useful of all the five fingers. It is the foreman of that brigade of five workers we call the hand. The thumb can pair off with any one of the other four fingers, or with all of them at once. That's why our hands can handle so many different kinds of tools so skilfully.

The hand of a chimpanzee is more like a man's foot. When he wants to get some fruit off a tree, the chimpanzee often holds onto the branch with his hands and seizes the fruit with his feet. And when he is walking along the ground, he supports himself with his hands. That is, he often uses his feet as hands and his hands as feet.

How much work do you suppose a human being could do if he tried to have his hands and feet exchange places ?

But, besides the construction of his tongue, of his feet, and of his hands, there is still another most important thing which animal trainers who try to make chimpanzees into human beings forget. They forget that the brain of a chimpanzee is much

smaller and has many less convolutions than the human brain. It took hundreds of thousands of years for an ape to become a man. For this one reason alone, because of the difference between their brains, it is impossible to teach a chimpanzee to think like a human being.

The chaotic movements of chimpanzees clearly express the chaotic nature of the activity of their brains, absolutely in contrast with the orderly and concentrated work of the human brain.

Nevertheless, a chimpanzee is quite intelligent enough and quite well enough constructed to carry on his life in his native haunts, in the forest—in that little world to which he has adapted himself during the course of millions of years.

Once a moving picture director came to take shots of Rosa and Raphael. He insisted that one of the shots should be of them at free play outside their quarters. So they were turned out. The moment they were free they made straight for the nearest tree, scrambled up the trunk and began jumping from one branch to another, chattering away in high glee. They felt far more at home in a tree than in their nice, comfortable little apartment.

At home, in Africa, the chimpanzee lives in the highest story of the forest. He builds a home for himself among the branches. He takes refuge from his enemies up among the tree tops. He finds his food, fruit and nuts, in the trees. He is so adapted to tree life that he can run along the trunks of trees much better than along the ground. You

never find chimpanzees where there are no trees.

Once a scientist went to Cameroons, Africa, to observe how chimpanzees live in their native haunts. He caught a dozen chimpanzees and settled them in a wood near his farm so they would feel quite at home. To keep them from running away he made a big invisible cage for them. This cage was built with just two tools, an axe and a saw. All he did was to have the trees cleared away for a considerable strip around a good-sized piece of forest, leaving an island of trees in the middle of a big bare open space. He put the chimpanzees in these trees.

His calculations were correct. The chimpanzee is a forest animal. That means he never leaves the forest of his own free will. It is as impossible to settle a chimpanzee in a treeless spot as it is to settle a polar bear in a desert.

Well, then, if a chimpanzee can't leave the forest how was it that his relative, man, managed to get out?

Our Hero Learns to Walk

Our forest man didn't break out of his forest cage in a single day nor in a single year. Hundreds of thousands of years passed by before he was free enough to go out of the woods into the treeless plains.

The first thing he had to do to break the chain that bound him to forest life was to come down out of the treetops and learn to walk on the ground.

It's no easy thing for a human being to learn to walk even today. Anyone who has visited a nursery school knows how they have a special class called "Creepers." Creepers are those children who have learned to move about from one place to another but have not yet learned to walk. It takes several months for a creeper to get out of the creeper class into the class of walkers. It's no joke to walk along the ground without putting your hands on it, or holding on to something near you. It's much harder than it is to learn to ride on a bicycle.

But the few months it takes a child to learn to walk are nothing compared to the thousands of years it took our ancestor to learn to do it. True, even when he still lived up in the treetops he did come down to the ground sometimes for a little while. It may be that he didn't always put his hands on the ground but took two or three steps on his hind legs, just as a chimpanzee does sometimes.

But two or three steps are quite different from fifty or a hundred! That means long and stubborn effort. Of course our ancestor might have remained a four-footed animal. But then he would not have been man. As man he could not use his hands to walk with, he had many other uses for them.

The Feet Free the Hands for Work

Even while still living in the trees our forefather learned to use his hands in a different way from his feet. He seized the fruit and nuts with his hands, he built his home in the crotches of the trees with his hands.

Now the hand that could pick a piece of fruit or a nut could also pick up a stone or a club. And when you have a club or a stone in your hand, it's as if you had made your hand longer and stronger.

With a stone you can crack a hard-shelled nut you can't crack with your teeth. With a stick you can dig up edible roots.

So, little by little, our ancestor began to add new articles to his food—things that birds and mice and moles were in the habit of eating. At first he ate this kind of food only when there was a scarcity of his own kind of food, when the forest had been stripped of fruit and nuts by bands of monkeys. After a while, as he grew more and more used to this new food, he came down from the trees oftener in search of it. He would dig in the grounds for tubers and roots and get them out with the help of a stick. With the help of a stone he would beat open stumps and get at the larvae of insects inside them.

If he was to have his hands free for work, he had to free them from that other job—walking. The more the hands were busy with work, the more the feet had to take over the job of walking.

So the hands set the feet to walking and the feet freed the hands for work. And a new kind of creature appeared on the earth—a creature that walked on its hind legs and worked with its front ones.

This creature still looked very like an animal. But if you had seen how he used a club or a stone,

you would have said at once: "This animal has already begun to turn into a man." For it is a fact, as you know, that only man can use tools. Animals have no tools.

When a mole or a shrew digs in the ground he never uses a spade; he uses his own paws. When a mouse cuts and gnaws a tree, he doesn't use a knife, he does it with his own teeth. The woodpecker doesn't use an auger to make holes in the bark of a tree; he uses his own beak.

Now, our forefather didn't have an auger-beak, nor shovel-paws, nor incisors sharp as knives. But he had something better than any incisors or tusks. He had a hand. And this hand could get for him incisors of stone and claws of wood.

Our Hero Comes Down to Earth

While all these things were happening, the climate of the earth was gradually changing. Ice fields of the far North were moving southward. Mountains were pulling their snowcaps farther down over their brows. Nights were getting cooler in the forest home of our ancestor, winters were growing colder. The climate was still warm, but it couldn't be called hot any longer.

On the northern slopes of the hills the evergreen palms, magnolias, laurels were giving way to oaks and lindens which could stand up against the cold by dropping their leaves in winter. These trees apparently give up the struggle during the winter and die for the time being, only to come to life again in the spring.

Fig trees and grapevines retreated before the cold and hid away in dells and along southern slopes. The boundary of the tropical forest kept moving farther and farther south. And the inhabitants of the forest moved south with the forest. The mastodon, ancestor of the elephant, disappeared. The saber-toothed tiger became rarer and rarer.

Where formerly there had been a thick tangle of undergrowth, there now appeared open spaces between the trees where great herds of deer and rhinoceros fed. Of the apes, some left, some died out.

It was not easy to adapt oneself to these new conditions. Foods suitable for apes became rarer and rarer all the time. There were fewer grapes, banana and fig trees were harder to find. Travel through the woods, from tree to tree, got harder, too. One had to run across open spaces between clumps of trees. The getting over the ground was hard enough in itself for a tree dweller, but there was the added difficulty of having to keep watch on all sides for some prowling beast of prey.

But our ancestor had no choice in the matter. Hunger drove him out of the trees. More and more frequently he had to come down out of the trees and prowl around on the ground, looking for something to eat, something that in other days no ape would have thought of putting into his mouth.

And what did all these changes mean for the wild animals, to leave the cages they were used to, go away from the forest world to which they

were adapted? Think what that would mean. It would mean changing all the forest rules, breaking the chains which bind wild animals to their places in nature.

Take a squirrel, for instance, who should try to exchange his forest life for life on the plain. On the plain he would have to eat grass instead of pine nuts and mushrooms. That would mean he would have to have a different kind of teeth. On the plain he would have to dig a hole for himself to live in. That would require a different kind of claw. And his fine tail, which serves him so well in the forest as he leaps from tree to tree, would be only a hindrance to him in his life on flat country. It would be like a red flag betraying him to his enemies.

Before a squirrel could leave the forest and settle in the plain, he would have to part with his parachute tail, and acquire teeth like those of a shrew or a field mouse. In a word, he would have to cease to be a squirrel. Or to go back to our fir-tree crossbill. Do you suppose it could settle in an oak grove and live on acorns? It could not. For its beak, so perfectly suited for getting nuts out of a fir cone, couldn't possibly open an acorn. If a crossbill wanted to leave his fir wood and go to live in an oak grove, he'd first have to get a different kind of beak.

True, birds and animals do change. Everything in the world is always changing. But it takes many years to effect these changes. Every offspring differs only the tiniest bit from its parents. There have to be thousands of generations before

If he happened to run into an enemy, he had his club and his stone, and he wasn't alone

a new, different species, different from the former one, is evolved.

Well, and how about our ancestor then?

If our ancestor hadn't changed all his habits and customs, he would have had to go south with the other apes. But by this time he was different from all the others because he could find food with the help of tusks and claws made of stone and wood. If he had to, he could get along without the juicy southern fruits which were getting rarer and rarer in the forest. And the fact that the trees were getting farther and farther apart did not worry him so much. He had already learned to run along on the ground and was not afraid of the open, treeless spaces. If he happened to run into an enemy, he had his club and his stone and he wasn't alone either. The whole band of "semi-people" would defend themselves together, and they all had clubs and stones.

The hard seasons which now set in did not kill off our ancestor nor force him to retreat with the retreat of the tropical forests. It only hastened his development into a human being.

And what happened to our relatives, the apes?

They retreated along with the tropical forest, and so remained forest dwellers. They had to retreat. They had not developed as our ancestors had. They had not learned to use tools. The cleverest of them who continued to live in the treetops learned to jump still more nimbly from limb to limb, to hang on still more firmly to the branches. In place of becoming human beings and learning

to work with their hands and walk with their feet, they, on the contrary, became still more ape-like, adapted themselves still better to life in trees. They learned to take hold of a branch not only with their hands but also with their feet. They learned to walk resting their weight on their hands, as chimpanzees still do. That one thing alone prevented them from ever becoming human beings, for human beings have to have their hands free to work.

Another fate befell those apes who were less nimble and not so good at adapting themselves to life in the trees. Only the very biggest and strongest of these survived, but the bigger and heavier an animal was, the harder it was for him to remain a tree dweller. Whether they liked it or not, the bigger apes had to come down to the ground to live. Gorillas, for instance, still live on the ground, on the first floor of the forest. They don't defend themselves from their enemies with stones or sticks, but with the huge tusks in their powerful jaws.

So the ways of man and of his relatives parted. Man went farther than any of the others. To good purpose he had learned to walk and to work.

The Missing Link

Man didn't learn to walk on two feet all at once. At first he was very clumsy and awkward in his gait.

How did a man, or rather an ape man, look in those early days of his existence?

There is no living example of this ape man anywhere in the world, because long, long ago he changed into a human being, but it is possible that his bones are to be found somewhere in the world. If we could find such bones, it would be final proof of man's descent from an ape. For this ape man is the connecting link of the chain which leads from ape to man. And this link is lost. No trace of it has been found as yet in the deep layers of clay and sand, or in the deposits along old river banks.

Archaeologists can dig in the earth, but before beginning to dig they must decide where to do the digging, where to look for this missing link. The earth is a rather large sphere, and to look for this missing link somewhere in its surface is about like starting out to find a needle in the sand.

At the close of the last century a famous scientist, Haeckel, suggested a hypothesis: Is it possible that the bones of this ape man, or in scientific language, Pithecanthropus, will be found in southern Asia?

He indicated the spot on the map where, in his opinion, the bones of Pithecanthropus might be preserved, the Sunda Islands.

Many people thought his idea just a fanciful notion without any foundation. But there was one man who was so convinced of its correctness that he decided to give up his work and go to the Sunda Islands to look for the bones of this hypothetical creature. His name was Doctor Eugene Dubois, a student of anatomy in the University of Amsterdam.

Most of his fellow workers, professors in the university, shook their heads and expressed the opinion that no man in his senses would do such a thing. They were sedate men, these college professors. The longest voyages they ever undertook were their daily walks to and from the university along the peaceful streets of Amsterdam, carrying their umbrellas in their hands.

But Dubois gave up his work in the university and enlisted in the Dutch colonial army so that he could carry out his purpose. He joined the medical service and so was able to travel over the seven seas to the far away Sunda Islands.

The moment he got to Sumatra Dubois set to work. He got a crew of men together and set them to work, digging under his direction. They dug up veritable mountains of earth and searched through it. One month went by, a second, a third, but no bones of Pithecanthropus turned up.

When you are looking for something you have lost, you at least know that the thing you are looking for is somewhere and, if you keep looking long enough, the chances are you'll find it. Dubois' job was much harder. All he had to go by was the supposition that there were some of these ape men's bones somewhere. Nevertheless, he kept right on stubbornly digging away. A year went by, two years, three years, and still the "missing link" had not been found.

Most people in Dubois' place would have given up the fruitless search. Even he must some-

times have had his doubts. As he wandered along the swampy river banks and through the tropical woods of Sumatra, he must often have thought wistfully of the old houses along the peaceful canals of Amsterdam, of the lovely gardens of blooming tulips, the white halls of his laboratory.

But Dubois was not the man to give up anything he had once undertaken. When he failed to find his Pithecanthropus in Sumatra, he decided to try his luck on another island of the Sunda group, Java.

And here at last luck favoured him.

In the bed of the river Bengawan, in the foothills of the Kendeng Hills, he found two teeth, a thigh bone and the top part of the skull of Pithecanthropus.

What he saw as he looked into the face of his ancestor and tried to imagine what the missing features were, was a low, sloping forehead with heavy, ridged brows under which had been the eyes. It was more like the muzzle of an ape than the face of a man. But when he looked inside the skull he was convinced that Pithecanthropus was more intelligent than any ape. The size of the brain cavity was much greater than that of an ape, the animal most closely related to man.

Part of a skull, two teeth, and a thigh bone. That isn't much. Nevertheless by studying them, Dubois was able to establish many facts. From a careful examination of the thigh bone and the scarcely visible marks left on it by the muscles, he came to the conclusion that Pithecanthropus had

already learned to walk, after a fashion, but had not entirely given up going on all fours.

He could easily imagine how his ancestor must have looked. How he must have roamed through the wooded country, hunched over, his legs bent at the knees, his long arms hanging down. His eyes, deep set under overhanging brows, are looking down—to see if he can find anything to eat.

This is certainly not an ape, but it is not yet a man. Dubois decided to give a name to his discovery, so he christened him: "Pithecanthropus Erectus," for, compared with an ape, he did walk upright.

You might think Dubois' work was finished now, since he had found his Pithecanthropus, but it was only the beginning. The hardest work was yet to come. It was easier to dig through those stubborn layers of earth than to break through the stubborn superstitions and prejudices of his fellowmen.

Dubois' discoveries were met with a hail of objections from all those people who were obstinately determined not to acknowledge that men have descended from apes. Archaeologists in cassocks and archaeologists in frock coats attempted to prove that the skull Dubois had found was the skull of a gibbon, the thigh bone, the thigh bone of a modern man.

Not content with turning Dubois' ape man into the arithmetical sum of an ape plus a man, his opponents threw doubt on the antiquity of his find and tried to prove that these bones had been lying there

only a few years, instead of for hundreds of thousands of years.

In a word, they did their best to re-inter Pithecanthropus, bury him again and consign him to oblivion.

Dubois defended himself manfully and was supported by all who understood the scientific importance of his discovery.

In answer to his opponents Dubois asserted that the skull of Pithecanthropus could not be that of a gibbon. A gibbon does not have bulging brows, whereas Pithecanthropus does.

But, in order completely to refute the objection, an entire skeleton would have to be found. So the search along the river Bengawan went on. In the course of five years 300 boxes of bones of prehistoric animals which had lived along the river bank were shipped to Europe. Scientists set to work to sort them out and study them. But among all these thousands of bones they succeeded in finding only three bones which might belong to a Pithecanthropus—three pieces of thigh bone.

Years passed and people still doubted the existence of Pithecanthropus. Suddenly a scientist found the next link of the chain, that is, the one which should come in between Pithecanthropus and man.

Forty years ago this scientist dropped into a drug store in Peiping looking for some Chinese medicine. A strange array of objects were spread out on the counter: a ginseng root that looked like a human skeleton and was supposed to have healing

powers, a lot of bones and teeth of animals, amulets of all kinds.

Among the bones the scientist found a tooth which was obviously not the tooth of an animal, yet was quite different from the teeth of contemporary man. He bought this tooth and sent it to a European museum where it was cautiously catalogued as "Chinese Tooth."

Two more such teeth were quite accidentally found some twenty odd years later in the cave of Chou-Kou-Tien, not far from Peiping—and a little later the owner of the teeth, whom scientists christened Sinanthropus.

To be exact, they didn't find him whole, but in the form of a collection of all kinds of bones. There were 50 teeth, 3 skulls, 11 jaw bones, a piece of thigh bone, a vertebra, a clavicle, a wrist bone, a piece of foot bone.

This does not mean, naturally, that the cave dweller had three heads and only one leg. There is a much simpler explanation. That is, that not just one single Sinanthropus lived in this cave, but a whole band of them. In the course of hundreds of thousands of years, many of the bones were lost. Maybe they were carried off by wild beasts. But, from the bones left, it is easy to imagine how the inhabitants of the cave looked.

How then did our hero look in that far-away period of his life?

It must be confessed that he was not remarkable for his beauty.

If you met him, you'd probably run away in terror. With his face thrust forward, his long hairy arms hanging down, he still looks very much like an ape. But if you took him for an ape at first sight, you'd soon change your mind. No ape walks upright, man-fashion. No ape has a muzzle that looks so much like a human face. And all your doubts would vanish if you should follow Sinanthropus back to his cave.

He hobbles clumsily along on his crooked legs. Suddenly he sits down in the sand. He has caught sight of a big stone. He picks up the stone, examines it, strikes it against another stone. Then he gets up and goes on, taking his find with him.

Following along after him you come to a high bluff. There at the entrance to a cave in the bluff are huddled a group of people like himself—the other cave dwellers. A bearded hairy old fellow is cutting up the body of an antelope with a stone tool. Women, standing alongside, are tearing the meat into pieces with their hands; children are begging for pieces of it. The whole scene is lighted by the glow of a bonfire burning inside the cave.

All your doubts would disappear. For was there ever an ape who could build bonfires or make stone implements?

You may quite rightly ask: "How do you know that Sinanthropus could make stone implements and knew how to use fire?"

The cave of Chou-Kou-Tien gives us the answer to this question. In the course of the excavations many other things besides bones were found

in it: a deep layer of ashes mixed with earth, and a pile of rude stone implements. More than two thousand such implements were found and the layer of ashes was nearly twenty-three feet in thickness.

Evidently members of the Sinanthropus clan lived in this cave for a long time and had fire for many, many years. It is probable that they did not yet know how to make a fire, but gathered it—just as they gathered roots to eat and stones for implements. They would find a fire burning in the forest somewhere and carefully carry home some of the smouldering firebrands, and there, in the cave sheltered from rain and wind, guard and cherish their fire as their most precious treasure.

CHAPTER III

HANDPRINTS

Man Breaks the Rules

Our hero picked up a stone or a club. He was immediately stronger and had more freedom. It didn't matter so much, now, whether the fruit and nuts he wanted were within his reach. He could go farther away from his usual neighbourhood in search of food. He could go from one small world into another. He could stay for some time out in the open spaces. In defiance of all the rules, he could take from other animals food he had never before thought of trying.

So, at the very beginning of his adventurous life, man was a breaker of rules which governed the world in which he found himself. This tree dweller actually comes down out of his tree and begins to roam about on the ground. He stands up on his hind legs, too, and begins to walk on them in a way he was never intended to walk. He doesn't stop at that either. He eats things he was not supposed to eat and gets his food in an entirely original way.

But the boldest thing of all is that he breaks the rules of the "food chain." He not only begins to eat strange food but he refuses to be food for the saber-toothed tiger that had eaten his ancestors for hundreds of thousands of years.

How dared he be so bold? How could he make up his mind to come down out of his tree to the ground, where fierce beasts of prey were lying in wait for him? You might as well expect a cat to come down out of a tree, when there's a fierce dog waiting for her underneath.

It was his own hand that made man so bold. That stone he had picked up, that club he used for getting food out of the ground, could also defend him. Man's first tool became his first weapon.

Then, too, he never roamed about through the forest alone. A whole band, all armed with stones and clubs, stood off the attacks of a wild beast together. If there were several cats in the tree with a fierce dog threatening them below, and if they were armed with clubs and stones besides, it's likely the cats wouldn't be afraid either to come down out of the tree and attack the very fiercest dog.

Then you mustn't forget about the fire. Man could scare away the most dangerous wild beast with fire.

Handprints

From treetops to the ground, from the forest to the river valleys went man, once he had broken the fetters which chained him to the trees.

How do we know man went to the river valleys? His tracks lead us there.

But how can tracks have lasted all this time?

We don't mean footprints. The tracks we're talking about are handprints.

A hundred years ago some workers were digging in the valley of the river Somme, in France. They were digging up sand, gravel, and stone deposited by the river in ancient times.

Long, long ago, when the Somme was still young, when it had just made a way for itself in the world, it was so swift and strong it carried whole boulders along with it. As it swept them along in its current it pounded one rock against another, smoothed them down, polished the irregular fragments, ground them into small pebbles and stones. Later, when the river quieted down and became more peaceful, it covered these pebbles and small stones with a deposit of sand and clay.

It was in this clay and sand the diggers were getting the rock. They noticed a very strange thing; some of the stones were not smooth. On the contrary, they were uneven, as if they had been chipped off on both sides. What could have given them such a shape? It couldn't have been the river, for it always polished them down smooth.

These oddly shaped stones happened to come to the notice of a local inhabitant, Boucher de Perthes, a scientist. He had in his home a rich collection of all kinds of relics which had been discovered along the banks of the Somme: tusks of mammoths, horns of the rhinoceros, skulls of cave

bears. He valued these relics very highly and was making an intensive study of these remnants of the terrible monsters who had come down to the Somme to drink in those ancient times, just as sheep and geese do today.

But where was ancient man? Boucher de Perthes had found no trace of his bones anywhere.

Then these strange stones, found by the diggers in the sand, turned up. Who could have sharpened them like that on both sides? Boucher de Perthes decided instantly that the only possibility was that it was the work of man. He was greatly excited by his new find. True, these were not actual relics of ancient man, but they were traces of him, traces of his work. This was clearly not the work of the river but of the human hand.

Boucher de Perthes wrote a book about his discoveries, to which he boldly gave the title: "About Creation. A Treatise about the Origin and Development of Living Creatures."

Then the fight began. Boucher de Perthes was attacked from all sides, just as Dubois had been. Outstanding archaeologists undertook to prove that this amateur provincial antiquarian knew nothing about science, that his stone "axes" were counterfeit, and that his book should be banned because it contradicted the teachings of the church about the creation of man.

For fifteen years the war between Boucher de Perthes and his enemies went on. Boucher de Perthes grew older, his hair turned gray, but he stubbornly kept up the fight to prove the great anti-

quity of the human race on the earth. Shortly after his first book he wrote another, and later a third.

He was fighting against great odds, but still he won out in the end. The geologist Leyell and Prestwich came to his aid. They went to the Somme valley and examined the shafts for themselves, studied Boucher de Perthes' collections and, after the most careful examination, announced that the implements found by de Perthes were genuine implements of primitive man who had lived in France during the time of mastodons and rhinoceroses.

Leyell's book, "Geological Evidences of the Antiquity of Man," silenced de Perthes' opponents. Then they all began to say that, after all, strictly speaking, de Perthes had not discovered anything new, that implements of primitive man had been found earlier.

Leyell, in answer to this, said wittily: "Every time there is an important scientific discovery, people at first say it contradicts religion, then they say that everyone had always known about it anyway."

Since de Perthes' discovery, lots more of these stone implements have been found. They are most frequently found along river banks where digging is going on to get rubble and sand.

So the spade of the modern worker meets there in the ground with the tools of those times when man had only begun to work.

The most ancient of stone implements are those which are chipped on two sides by another stone. But along with these they find also the chips, the

bits splintered off when the stone was broken to pieces.

These stone implements are the hand tracks we meant, the tracks that lead us to the river valleys and river shoals. There in the river deposits and in the shoals man looked for materials suitable for his artificial claws and tusks.

This was a distinctly human occupation. An animal can look for food or for building material for his nest. But he will never be found looking for material to manufacture artificial claws and tusks for himself.

A Living Spade and a Living Cask

We've all heard much about the skilled work of animals—about animals who are builders, masons, carpenters, weavers, and even tailors. We know, for instance, how beavers fell trees with their sharp, strong incisors quite as neatly as woodcutters; how they made real dams of tree trunks and branches so the river spreads out and forms a pond.

And the common red ants! Just poke a stick into an ants' nest and you'll see what a real city they have built for themselves underground.

So, you ask: "Isn't it possible that some time ants or beavers would catch up with man if man didn't destroy their constructions? And might it not be possible that in a million years or so ants will be reading ant newspapers and working in ant factories, flying in ant airplanes and listening to ants making speeches over the radio?"

No, in our opinion, this would not happen even in ten million years. For, you see, there is one very important difference between a man and an ant.

What is this difference?

Is it perhaps because a man is bigger than an ant?

No!

Is it perhaps because ants have six legs and man has only two?

No! That's not the difference we mean.

How does man work? He doesn't work with his bare hands and teeth, but with an axe, with a spade, with a hammer. And no matter how long you look for them in an ants' nest you will never, never find there either an axe or a spade. When an ant has to cut something in two, he uses living shears which are on his own head. When he wants to dig a canal, he uses four live shovels which he has always with him, four of his six feet. He digs up the earth with the two forefeet, throws it out of the way with his two hind ones, meantime supporting himself on the two middle ones.

He even has living utensils. There is a certain kind of ant which has cellars full of living casks. Down in their dark little cellars hang closely packed rows of these casks. There they hang absolutely motionless, each one looking just like all the others. But watch when an ant goes into the cellar. He goes up to a cask, strikes it with his antennae, and it begins to move.

It turns out that the cask has a head and chest and feet. The actual cask is the belly of an ant which is clinging to the rafters of the ceiling. It opens its jaws and out of its mouth comes a drop of honey. The ant worker, who had come down to refresh himself, licks up the honey and goes back to his work. The ant cask again hangs motionless among the other casks.

That's the kind of "live" equipment ants have. Their implements and their utensils are not manufactured ones as they are with human beings. They are natural ones from which they are never separated.

The beaver's implements are alive too. He doesn't cut down trees with an axe. He does it with his teeth. That is, neither the ant nor the beaver makes his own tools. They are born with a full set of tools.

At first glance this might seem an advantage; you couldn't lose a living tool. But on reflection you will see that such a tool is not so good. You can't mend it and you can't improve it.

A beaver can't take his incisors to a machine shop where they sharpen up those that have grown dull with old age. And an ant can't send in an order to the store-room for a brand new spade so he can dig up the earth better and faster.

Man with a Spade for a Hand

Suppose man had living tools, like the other animals, instead of implements made of wood, iron, and steel.

He couldn't get any new ones, he couldn't make over the old ones. If he wanted to dig he'd have to be born with a hand like a spade.

It's a wild supposition, but let's just imagine, anyway, that such a monster was born. He'd doubtless be a splendid digger, but he couldn't teach his skill to anyone else, as a person with extraordinarily good eyesight can't possibly teach it to another.

He'd have to carry his shovel-hand with him all the time, and it wouldn't be good for any other kind of work. And when he died his shovel would die with him.

The only way this natural digger could pass his skill on to posterity would be by inheritance, if some of his children or grandchildren inherited this monstrosity from him, as people inherit the colour of their hair or the shape of their noses.

And this isn't the worst of it. Living tools are kept and handed down by inheritance only when they are useful to an animal, and not harmful. If people lived underground, like moles, they would naturally find shovel-hands useful. But for a creature living above ground, such a paw would be a superfluous luxury.

You can see how many conditions are necessary to create a new tool if it is a living, natural one, and not a manufactured one. Fortunately for us man took another path. He didn't wait to grow a shovel instead of a hand. He made himself one, and not only a shovel—he made himself a knife, too, and an axe, and many, many other tools.

To the twenty fingers and toes and the thirty-two teeth he received from his ancestors, he added thousands more of all sorts and descriptions: long ones and short ones, thick ones and thin ones, sharp ones and dull ones, prickers and cutters and beaters—fingers, tusks, claws, fists.

It was this that gave him such a head start in his contest with the other animals that it was utterly impossible for them ever to overtake him.

Man and River as Toolmakers

When man was just beginning to be man, he didn't make his tools, he simply picked up his stone teeth and claws as we now gather mushrooms or berries. For a long time he roamed along the shoals of streams looking for stones that had been polished and shaped by nature.

These sharp pointed stones were most common near where some mad whirlpool had beaten and polished the stones, banging them about against one another as in a giant rattle. Obviously the river craftsman didn't give a thought as to whether or not his work would be of any use. So, among hundreds of stones turned out by nature, only a few were useful to man.

So man himself began to shape the stones to suit him, began to make tools. This is what has happened many times in the course of the history of mankind; man has replaced something found ready at hand in nature by an article of his own manufacture. He has set up for himself his own little workshop in one of the corners of the great

workshop of nature, and there made new things.

That was the case with stone implements and so it was later, thousands of years later, with metal. In place of using the pure nuggets of metal, which are not so easy to find, man began to smelt it out of ore. And every time man passed over from using what he found in a natural state to using something he made himself, he took one more step toward freeing himself from dependence on the harsh power of nature.

At first he, himself, could not make the material for his tools. In the beginning he only gave new forms to such materials as he found ready at hand in nature.

He picked up a stone and shaped it by pounding it with another stone. At first he got only a rude implement, roughly like an axe or cleaver. Such a tool was good for chopping. The chips of stone could also be used for cutting and scraping and making holes.

The very oldest implements, found buried deep down in the earth, are so like stones which have been shaped by nature that it is hard to say whether the craftsman was man or the river, or whether it was simply the action of heat and cold in connection with the water which broke and scaled off the stones.

But other tools are found about which there cannot be the least doubt. Along old river shoals and banks where excavations have been made, under thick layers of clay and sand, whole work-

shops of primitive man have been dug up, with a supply of axes and chips which served as tools. If you examine one of these chips, you can see just where it was struck to sharpen it and how it was trimmed to make it a suitable tool.

You don't find such tools in nature. Only man can make them.

It is easy to see why this is so. In nature everything is done without purpose or plan, just of itself. The whirlpool in the river beat the stones about just any way, without thought at all. Man did the same kind of work, but he did it consciously, with an aim. So purpose and planning made their first appearance on earth. Man began little by little to improve on nature, to make it over, when he improved on the stone supplied him by nature.

And this raised man still another step above the other animals, gave him greater freedom. Already he was not dependent on the finding of such a stone as he needed all ready for him in a natural state. He could now make his own tool.

The Beginning of a Biography

A biography usually begins by telling the time and place of a man's birth. For example:

"George Washington was born at Bridges Creek near Fredericksburg, Va., on the 22nd of February, 1732."

We've already got to page 73 and haven't yet said where and when our hero was born. We have to confess that we havn't even given him a name.

In one place we have called him "ape man," in another "semi-man," and at other times we have spoken of him more vaguely as "our forest ancestor."

Permit us to say a few words in self-defence.

To begin with the name of our hero. With the best intentions in the world, we could not give him a name, because he has so many names.

If you glance through any biography you will see that from the first page to the last the hero keeps the same name. He grows from childhood to manhood, but his name doesn't change. If he was named George when he was born, he remains George to the end of his days.

It's more complicated with our hero. He changes so much from chapter to chapter that, whether we want to or not, we have to change his name.

Of course the simplest thing would have been to call him just "Man" from the very beginning. But how can one call present-day man and Pithecanthropus, who is so very like an ape, by the same name ?

Sinanthropus is a little less like an ape, but even he can hardly be called a man.

The Heidelberg Man is still nearer to us. It is hard to say how he looked, for all that is left of him is a jaw found near Heidelberg. But, judging from this jaw, we may say that he may rightly be given the name of man. His teeth are not the teeth of an animal but of a human being; there are no longer protruding tusks that stand out beyond the other teeth as they do in an ape's mouth.

Nevertheless, even the Heidelberg Man is not yet a genuine man. This is evident from his forehead which slopes back like an ape's.

Pithecanthropus, Sinanthropus, Heidelberg Man! Three names already!

We might continue this list of names even further: after Heidelberg Man came the Eringsdorf Man, after the Eringsdorf Man the Neanderthal Man, after the Neanderthal Man the Cro-Magnon Man.

What a lot of names for one hero! But we must not get ahead of our story. In this chapter the name of our hero is Heidelberg Man.

It is he who roams along the banks of the river looking for material for his tools. It is he who, shaping one stone with another, makes the crude axes which are found today in the ancient river deposits.

The reader can see that it is not so easy to give our hero a name.

It is harder still to tell the year of his birth.

We cannot say our hero was born in such and such a year. Man did not become man in a single year. Hundreds of thousands of years separate Pithecanthropus from Sinanthropus, Sinanthropus from contemporary man.

If you remember that Pithecanthropus lived about a million years ago you may say that the human race is about a million years old.

It is the hardest thing of all to tell the exact place of the birth of our hero. In trying to do this we have tried to show where his grandmother lived

—that old fossil grandmother from whom sprang man, the gorilla, and the chimpanzee. Scientists call this ape Dryopithecus. When we tried to find the address of Dryopithecus it turned out that there were several tribes of that name. Some trails led to Central Europe, others to Northern Africa, others to Southern Asia.

Furthermore, we recalled that the bones of Pithecanthropus and Sinanthropus were found in Asia, whereas the Heidelberg Man was found in Europe.

Now just try, after that, to say where man was born! It's not a question of finding out merely in what country, but on what continent.

We began to think it over. Shouldn't we look there where the old implements were found? For when he began to make tools man was man beyond doubt. Perhaps these implements would help us to decide where man first appeared.

So we took a map of the world and marked on it the places where these ancient implements had been found—the crude stone axes. There were a good many dots on the map when we got through. Most of them were in Europe, but they also occurred in Africa and Asia.

Only one conclusion could be drawn from this: man first appeared in the old world and not in one place, but in different places.

Man Gets Time

Everybody knows how we get iron, how we get coal, how we get fire.

Well, then, can you tell me how we get time?

That's not so well known.

But it is nevertheless a fact that man long ago learned how to get time. When he began to make tools, he introduced into his life an entirely new occupation—work. Now work took time. To make a stone implement man, first of all, had to find a suitable stone. And this was not so easy, for not every stone under foot would do.

The best kind for making tools were hard, solid stones. And not every stone lying around was hard and solid. It took some hunting to find the right kind. Man spent a lot of time looking and sometimes even then he couldn't find what he was looking for. Then he'd have to use a more porous stone, or even be satisfied with soft stuff like limestone or sandstone.

And when he did find a suitable stone he had to have another stone to pound it smooth and shape it right. And that took more time. Man's fingers were not so deft as they are now. He had only just learned to work. He doubtless spent much more time making his crude stone axe than it takes to make a steel one today.

But where was he to get his time?

Primitive man had very little free time; much less, I assure you, than even the busiest man in our day. From morning till evening he roamed the woods and the open spaces in the forest gathering food, cramming everything that could possibly be eaten down his own throat or into the mouths of his children. Gathering food and eating it—

that's how man spent all his waking hours. For, you see, he had to have a lot of the kind of food he got. You have to eat more when your menu consists entirely of berries, nuts, tree shoots, leaves, larvae, and such tid-bits.

The human herd pastured in the woods just as a herd of deer do now who have to spend all their time nibbling off the low growing things and chewing them, and then barely managed to get a living. And if he had to spend the entire day looking for food and eating it, when could he work?

And now a wonderful thing happened; work proved to have a magical power—it not only took time, it also gave time.

You can see that if you succeed in doing something in four hours that it had taken someone else eight hours to do, that means you've gained four hours of time. If you invent a tool that reduces the time for a certain piece of work by half, that means you've freed half the time it formerly took for this piece of work.

Man, while he was still in a primitive stage, discovered this means of gaining time. He had to spend many an hour shaping his tool, but afterwards it was much easier to scrape larvae from under the bark with this sharp tool. It was a long job to plane down a stick with a sharp stone, but afterwards it was much easier to dig up edible roots with this stick, or to kill a little animal darting through the grass.

So the gathering of food went faster and this meant that man had more time for work. The

hours he didn't have to spend looking for food, he now spent making his tools. He kept making them better and sharper and every new tool gave him in turn more food, which meant also more time.

Hunting, especially, could give him much more time. For he could get enough meat in half an hour to last for the whole day. But at first, he didn't often have meat to eat. He couldn't kill big animals with a stick or a stone and there isn't much meat on a field mouse.

Man was not yet a real hunter.

What was he? He was a gatherer.

Man the Gatherer

It's nothing for us to be gatherers. Everybody has spent whole days picking mushrooms or strawberries. And how delightful it is to find a brown-capped mushroom hiding in the moss or suddenly catch sight of a shining red-capped one gleaming in the grass! How delicious it feels to run one's fingers down into the moss or grass and carefully lift out the plump stem of a black-fringed one!

But just suppose gathering mushrooms or berries was your sole occupation. Do you think you'd always have enough to eat? When you go to pick mushrooms you sometimes come home with your basket full to the top and a hatful besides. But also, you sometimes come back, after tramping the woods all day, with just one little mushroom lying in the bottom of your basket.

A little nine-year-old girl of our acquaintance always boasts when she sets out for a walk in the woods:

"I'm going to get a hundred mushrooms!"

But she often comes home empty-handed. And if there were nothing else to eat at home, she would starve to death.

Man, the gatherer in those early times, was even worse off. If he didn't starve to death it was only because he ate every edible thing he found and spent the whole day looking for it.

Although he was stronger and freer than his tree-dwelling ancestors, he was still a poor, half-starved creature.

And to make matters worse a terrible calamity was impending!

CHAPTER IV

THE END OF ONE WORLD AND THE BEGINNING OF ANOTHER

An Impending Calamity

For some reason, which has not yet been discovered, the northern ice fields again began to move south. Great ice rivers, glaciers, crept down along the hillsides and through the valleys, furrowing and gouging out the sides of mountains, slashing off the tops of hills, breaking off and twisting round whole cliffs, carrying along with them masses of debris. At the front the melting ice of these glaciers became rivers of water, plunging down the mountains, cutting channels for themselves through the earth.

The glaciers moved down from the North like the columns of an advancing army. And the ice packs of the canyons and valleys of the mountains crept out, like allies, to meet these oncoming ice fields from the North.

We can still trace the path of these ice rivers by the boulders scattered here and there in the val-

leys of France and neighbouring countries. Sometimes in a thicket of wood, in Germany, you come suddenly upon a huge, moss-covered boulder among the pines. How did it get there? It was brought by a glacier.

Several times before this the ice fields of the North had crept South. But this time they went farther than they ever had before. In western Europe they reached the mountains in the middle of Germany and they almost covered the British Isles. In North America they got further south than the Great Lakes.

They did not come on swiftly. Their icy breath was not immediately felt in those places where man lived. Animals living in the sea felt this icy breath before land dwellers.

It was still warm along the seashores. Laurels and magnolias still flourished in the woods. Huge elephants and rhinoceroses still roamed through the valleys trampling down the high grass. But the sea was growing colder and colder. The ocean currents, those rivers which flow through the ocean brought the cold down with them from the northern icebergs. Sometimes they brought down the icebergs themselves.

Sediment along the seashore still speaks eloquently of how these warm seas were changed into cold ones. While the land was still populated by animals that live only in a warm climate, the population of the sea had changed entirely. In the deposits of that period we find many shells of those mollusca which can live only in cold water.

War of the Forests

But on the land, too, the approach of the ice fields was beginning to be felt. You can imagine that it was no laughing matter when ice fields of the Arctic began to creep southward. The fir woods of the North moved south. As they retreated, they began to crowd out the leafy woods. A great thousand year war of the forests began.

Forests are at war today too. The fir and the aspen are always at war with each other. The fir likes shade, the aspen likes light. The aspen hides low in the fir wood like little tree shoots. The firs crowd them out and give them no chance to grow.

But when people come and cut the fir trees, the aspens immediately come to life in the brighter light and begin to grow like mad. Everything all around begins to change. The shade-loving mosses which grew at the feet of the firs die out. The young fir trees which were spared by the sawyers, dry up in the hot sunlight. While their mothers, the big firs, were there, they flourished in the shade under their thick, protecting petticoats. Left without any protection from the sun, they get sickly and die.

The aspens, on the contrary, celebrate their triumph. Formerly they had to subsist on the few rays of sunshine that managed to steal through the branches of their rivals, the fir trees. But the firs have been cut down now and the aspen is in pos-

session of the field. And soon a sunny aspen grove springs up in place of the fir wood.

But time goes on. Time is a great worker. Little by little it makes over the forest house. The aspens get taller and taller, their leafy tops are crowded closer and closer together. The shade at their feet, at first dappled with sunlight, became denser and denser. The aspen had been the victor but its victory was its destruction.

There is no record of anyone ever having been killed by his own shadow. But in the life of a tree this does happen. The little firs that managed to survive flourish in the shade of the aspens. Soon the ground is covered with the prickly little green needles of the firs. In a few more years the tops of the firs are level with the tops of the aspens. The forest is divided between the two; the light green of the aspen alternates with the dark green pointed tops of the firs. The firs keep on growing upwards and finally their thick dark branches shut off the sunlight from the aspen leaves.

That's the end of the aspens. They begin to die off in the shade of the firs. The fir comes into its rights. The fir forest stands again in its old place.

That's the way forests wage war when the woodman's axe interferes in their lives.

The war they waged when glaciers came into their lives was a far fiercer one. The cold killed off the trees that liked warmth and left the way clear for the forests of the North. The pine, the fir, and the birch were victors over the oak and the linden. The oaks and lindens, as they fell back,

crowded out the last remnants of evergreen, laurel, magnolia, and sycamore.

In spots exposed to cold and wind it was harder for the tender, warmth-loving trees to hold out and they perished, making way for their conquerors or moved farther and farther south. It was easier for them to resist in mountainous regions. They found refuge in protected canyons and held out there as if in a besieged fortress. But other glaciers came creeping down on them from the mountain tops, with an advance guard of mountain tundra, mountain firs and birches leading the attack.

And what happened to the animals who lived in those forests which were routed in their battle with the conquerors from the North?

Today, when a forest is destroyed by cutting down or by a forest fire, the inhabitants either perish with it or escape and run away. When a fir wood is cut down, its indigenous inhabitants, or prisoners rather, disappear with it: the fir-tree crossbill, the squirrel, etc.

Where their shady fir tree house stood, a new forest home of aspens grows up. In this new home other birds and other animals make merry.

And when many, many years later the fir conquers the aspen, the new fir wood which takes the place of the aspens will not be empty either. The squirrel, the crossbill, and their friends will settle there again.

A forest both dies and is born again as a whole, indivisible world, not as a mere chance groupings of vegetation and animal life.

That was the case during the Ice Age. The dwellers in the warmth-loving forests disappeared. There were no more mammoth elephants. The rhinoceroses and the wild oxen went south. That old enemy of man, the saber-toothed tiger, died off.

Along with these giants most of the other birds and animals who had lived in the forests either died out or went south. It could not have been otherwise. For every living animal is bound as with chains to his world, to his own forest, and when that world began to disappear or move, it swept away with it many of its inhabitants.

When the trees, the shrubs, and the grasses died off, the animals that had fed on this vegetation and found shelter under their protecting branches, were left without food and shelter. And these animals in their fall dragged down with them other animals, beasts of prey. For when there were fewer grazing animals, the beasts of prey who lived on them starved to death too.

Bound together by the "food chain," animals and plants perished together when their forests perished, just as in olden times galley slaves, chained to their seats, went down with their vessel.

The only way to survive was to break the chain, begin to eat a different kind of food, change the form of their claws and teeth, grow themselves long wool to protect them from the cold.

But we know how hard it is for an animal to change himself. Two craftsmen have to work at that, inheritance and variation. And these craftsmen both work very, very slowly.

It was a hard matter for a southern animal to get along in a northern forest and, furthermore, the hairy masters of the northern forests came down with these forests: the wooly rhinoceros, the mastodon, the cave lion, and the cave bear. These animals felt quite at home in the northern forest. They had such wonderful fur coats, thick and warm. The cold, so unbearable to the elephant, the hairless rhinoceros, and the wild ox, was nothing at all to a mastodon or a woolly rhinoceros. Also, several of these northern animals knew how to protect themselves from the cold by hiding in caves. And they had no trouble either in finding food in these forests, because it was their forest, their world.

So the former inhabitants of the forests which were dying out also had to contend with these new masters. Is it any wonder few of them survived?

And man, what became of man?

Man, of course, survived. If he had died out, you would not be reading this book.

Those who lived in warm countries got along very well, although even there the climate got cooler. Those in places which felt the full force of the oncoming ice fields had a harder time of it.

Shivering, their teeth chattering, huddled together in a bunch so as to keep themselves warm and protect their children from the cold, they met the first snows, the first terrible days of winter.

Hunger, cold, and wild animals threatened them with death. If they had been able to think about what was going on about them, they would

probably have thought the world was coming to an end.

End of A World

The end of the world has often been prophesied.

When a long-tailed comet appeared once during the Middle Ages, people crossed themselves and said:

"The world is coming to an end."

When an epidemic, the black plague, emptied the towns and filled the cemeteries, people whispered in terror: "The world is coming to an end."

But the world wasn't coming to an end.

We now know that the comet did not come to announce any future event, but was following its own course around the sun, and it cared little about what superstitious inhabitants of the earth were thinking about it.

We know that famine and epidemics, and even war, do not mean the world is coming to an end. The important thing is to know the cause of a calamity. If you know the cause, you can fight it better.

It is not ignorant, illiterate people only who prophesy the end of the world. There are scientists, too, who prophesy the end of the world and of the human race. Some of them, for example, assert that mankind will die out from a lack of heat. They give figures to support their forecast. The world supplies of coal are diminishing all the time, forests are constantly being cut down, and

there is hardly enough oil left for many hundred years. When there is no fuel left in the world all the machines in the factories will have to stop, trains will halt, fires in houses and lights on the streets will go out. The majority of the people will die of cold and hunger. Those who are left will go wild, again become primitive wild animals. It's a rather horrifying picture they draw for us!

And the worst of it is, there really is not very much fuel in the world compared with the amount man found. Some time it will all be used up.

And will this be the end of the world?

No, it will not!

For fuel is not the only source of heat and energy in the world. The main source of energy is the sun. And there is no doubt that by the time all the supplies of fuel have been used, people will have learned to set the sun to running trains, lighting homes and streets, turning the wheels of machines and even cooking our meals. Even now there are some experimental electric stations which get their energy from the sun and the first sun kitchens have appeared.

But, say these people who are in such a hurry to bury the world, the sun will also grow cold some time. Already it is less hot and burning than some young stars. In millions of years the temperature of the sun will become so low that the world will grow colder. Great polar bears will roam where palms grow now. And that will not be so good for human beings.

It would surely be very bad indeed if another Ice Age should come. But primitive man was able to survive the ice! And do you suppose the people of the future, armed with science incredibly more advanced than it is today, will be unable to survive?

We may even foresee what they will do to conquer the cold. They will bring atomic energy to the aid of the sun's rays, energy now hidden away in the innermost cells of matter. And there will be no end to atomic energy. The only thing is to find out how to release it.

But it is time to stop talking about this remote future, and return to a time not less remote, the past, the time of primitive man.

The Beginning of a World

If man had not broken those chains which bound him to his native forest, the end of the forest world would have been the end of him, too.

But the world was not coming to an end, it was only changing. The former world was coming to an end, a new one was beginning.

To survive in the new, changing world, man had to change too. His former food had disappeared. He had to learn to get some new kinds of food. The hard fir and pine cones were not for his teeth, used to the juicy fruits of southern forests.

The weather was getting colder all the time. The sun seemed to have left the world in the lurch and man would have to learn to live without the warmth of its rays.

He must become another kind of person, and in a hurry too!

Man was the only living creature that could do this. You see, he had already learned, before this, how to change himself. He alone of all the animals in the world had learned to do this.

Man's rival, the saber-toothed tiger, couldn't grow himself a heavy fur coat. Man could. All he had to do was to kill a bear and skin him.

The saber-toothed tiger couldn't make a fire. Man could. He already knew the use of fire. He had reached the point where he could change himself and correct nature.

And though many thousands of years have passed since that time, we can still see just what man did change in nature, and how he changed himself.

A Book with Stone Leaves

The earth under our feet is like a big book. Every layer of the earth's crust (every stratum of deposits) is a page in this book. We are living on the topmost, the very last of these pages. The first pages are away down on the floor of the oceans and the underlying foundations of the continents.

What came before that, what was in the chapters before these earliest pages, we can only guess. But the nearer the pages of the book are to us, the easier they are to read.

Some of the pages are scorched and warped by fire. They tell us how lava poured out from underground and buckled up on the earth into great

mountain ridges. Other pages tell how the earth's crust rose and fell, letting seas spread out over the land and driving them back again.

Right next to the pages (strata) white as the sea shells of which they are composed, come pages black as coal. And it is coal. In its black mass may be read the history of those giant woods which once grew on the earth. In certain places, like maps in a book, you find prints of leaves and bones of the animals who lived in the vegetation which later became coal.

So, reading page after page, we can read the history of the earth. And it is only on the very last pages, at the very end of the book, that our hero, man, appears.

At the beginning one might think he is not the chief hero of the big book. He seems to be only a minor character alongside of the giants, like the ancient giant elephant or rhinoceros. But the more we read, the more the new hero moves into first place. And the time comes when man becomes not only the hero of the big book, but one of its authors.

Look at that cut along the river bank. A distinct black mark appears among the deposits left by the ice age. This mark was made by charcoal. Where did it come from, this layer of coal right in the midst of this sand and clay? Maybe there was a forest fire there?

If it were the mark of a forest fire, the charred stuff would spread over a wide area, and here there is only a little layer of charcoal. Only a bonfire could

have left so small a layer. And only man could have built a bonfire.

And, sure enough, near the fire we find other tracks of man's hands: stone implements and the scattered bones of animals killed in hunting.

Fire and hunting—there we have the two things with which man faced the ice.

Man Leaves the Forest

Man found almost nothing he could gather in these severe northern forests. So he began to look through the forest for some other kind of booty, something that did not stay in one place and wait to be gathered, but ran away and hid from its pursuer.

Even in the warmer parts of the world, man at this time was beginning to add meat to his diet oftener and oftener. Meat was more satisfying, meat gave more strength and left more time for work. Man's growing brain needed a nourishing food like meat.

As man improved his implements, hunting began to take a more important place in his life.

If hunting was becoming a necessity even in the warm South, in the North it was absolutely impossible to live without it. Man could no longer get enough small animals to satisfy his needs. He had to have bigger prey. Snow made hunting in the North hard, too. Snow, and blizzards, and freezing weather. This meant one had to have meat on hand to last for a long time.

So what kind of animal did man begin to hunt?

There were a number of big animals in the forests. Reindeer fed on the moss in the open spaces. Wild boar rooted up the ground. But the biggest animals were not found in the forest, they were in the plains where bushes grew. Herds of bison thundered over the plains, making the earth tremble under the pounding of their feet. Like moving mountains these woolly giants, mastodons, lumbered slowly along.

For primitive man this was meat in motion, fleeing before him, beckoning him on like a will-o'-the-wisp.

So, going out in pursuit of his prey, man left his native forest where he had been born and brought up. His settlements spread farther and farther out over the plains and valleys. Traces of his fires, of his hunting camps, are found far away from the forests, in places where a forest man, a man-gatherer, never lived, never could have lived.

A Word We Must Interpret

In the hunting camps of primitive man we find bones of animals that were killed in the chase. There are the ribs of horses, the horned skulls of cattle, the curved tusks of wild boars. There are sometimes great heaps of such bones, showing that man often stayed a long time in one place.

And the most remarkable thing is that among these bones of horses, wild boars, and bison, we find also the gigantic bones of the mammoth:

their huge skulls, their long, bow-shaped tusks, their grater-like teeth, their gigantic legs, and pieces of their trunks.

How bold and strong the creature that could kill such a giant as a mammoth must have been! And he would have had to be still stronger to cut up the carcass and carry it back to camp, for each leg weighed almost a ton. The skull was as big as a man.

Hunters today have special weapons for hunting elephants. And primitive man had no firearms. His whole equipment consisted of a stone knife and a spear with a sharp pointed stone fitted in the end.

True, during the many thousands of years which separate man, the hunter, from man, the gatherer, his stone implements had changed, had become sharper and better. To make a stone knife or a stone spear point man had first to chip off the outside layer, then smooth off all the bumps and irregularities, then split the stone into layers, and finally, of these layers make the sharp edge he wanted.

To make a knife of so unsuitable a material as stone required great skill and a lot of time. So when he had once made such an implement, man did not throw it away after using it, he took good care of it and sharpened it when it got dull. He treasured his implement because he valued his work and his time.

But no matter what you do, a stone is still a stone. A spear with a pointed tip was a poor weapon when you had to deal with such an animal as

a mammoth. For the mammoth had a hide as thick as steel armour plate.

Yet man did kill mammoths. The skulls and tusks found in their camps tell us that.

How did primitive man cope with such a huge beast?

Only when the word "man" is interpreted as meaning "people" can we understand this. Singly, man could never have got the better of any great animal. But would man be what he is if he had been alone? Not man, but people with their combined strength learned to make implements, learned to hunt, to make fires, to build houses, to make the world over.

There are books which picture a primitive hunter as a kind of Robinson Crusoe who, by his own persistence did everything for himself. But if man had really been such a lone Robinson Crusoe, if people had lived in separate families and not in whole societies, they would never have become people nor created a civilization.

As a matter of fact, Robinson Crusoe's life was not what it is represented in Defoe's book. Defoe took as the foundation the story of a sailor who really lived once upon a time. This sailor was the instigator of a mutiny on board ship, so they left him on a little, uninhabited island in the middle of the ocean. Many years later, some travellers visited this island and found the sailor there, the only inhabitant of the island, absolutely alone. But the old sailor had almost forgotten how to talk and was more like a wild beast than a man.

If, even in modern times, it is hard for a human being to remain human when he is in absolute solitude, what could we expect of primitive man!

Men became human only because they lived together, hunted together, made their implements together. The whole tribe hunted all huge animals together. Not one spear but dozens landed in their hairy sides. The human band, like a many-legged, many-handed creature, chased the mammoths. And not only dozens of hands, but dozens of heads were working too.

A mammoth was many times bigger and stronger than a man, but people were cleverer.

A mammoth was so heavy it was nothing for him to trample a man to death. But people used this very weight to get the better of this giant who weighed so much the ground would hardly support him.

They surrounded him on all sides and started a fire on the marshy plain where he lived. His eyes blinded by the glare of the fire, his wool scorched and smoking, the mammoth ran wherever the fire chased him. And through the clever planning of man, the fire chased him right into a swamp.

Filling the air with his terrified trumpetings, the mammoth would try to get first one foot, then another, out of the mire, but the harder he worked the deeper he sank. Then all the people had to do was to kill him.

It was not easy to chase down and kill a great elephant, but it was harder still to drag him back

to their camp. A camp was usually situated on a high river bank, to be out of reach of floods. They used the river water for drinking and they could find stones suitable for making their implements in the shoals of the river.

This meant the carcass had to be dragged uphill from the low swamp. And here again not one pair of hands but dozens set to work. With sharpened stones they patiently hacked, cut, sawed the thick skin, the tough sinews, the huge muscles of the mammoth. Experienced ones, the old men, showed them where to find the joints to cut the head and legs off quickly. Finally, when they had the carcass cut up, they would carry it off to their camp in pieces.

Dozens of people, shouting in unison to make them pull together, would drag a great, hairy leg along, or a head with the long trunk trailing on the ground.

They were dripping with sweat and exhausted when they reached camp. But what a celebration began! People knew that a mammoth meant a great feast such as they had not had in a long time. They knew that a mammoth was food for many and many a day.

End of the Contest

Man's contest with the other animals was over; man came out the victor at the end. He had beaten the biggest animal of all.

This was a contest for food rather than a race. Who was going to eat whom? Man became the

one who eats all the other animals and is not eaten by any of them.

The result was that the number of people in the world began to increase more rapidly. Every century, every thousand years, there were more people, so that they finally settled the whole world.

Something happened that could not happen to any other animal.

Would it be possible, for instance, for rabbits to become as numerous as human beings?

You can see that it would not. For there would not be enough food in the world for billions of rabbits. And besides, while the number of rabbits was increasing, the number of wolves would increase too, and the wolves would see to it that the number of rabbits was reduced again.

That is, the number of animals in the world cannot increase indefinitely. There is a certain limit which it is hard for them to pass. It depends on what they eat and who eats them. True, sometimes rabbits get so numerous they become a real pest to men. That happened once in Australia, when rabbits were brought there from Europe. The rabbits increased to such numbers there was no saving the gardens from them.

The Australians had to send to Europe for a special kind of fox to reduce the number of rabbits in the country and restore the balance which had been disturbed.

This is a case of man's upsetting the order of nature and restoring it again.

For himself, man had long ago removed all the bonds and limitations set up in nature as barriers to animals like him. He began to make implements, to eat strange food; he forced nature to be more generous to him. Where formerly only one human band could find enough to eat, two or three could now exist.

And when he began to hunt the big animals, he still further enlarged his place in nature.

Now he didn't have to gather plants to eat. The bison, the horses, the mammoths gathered them for him. Droves of these animals roamed over the plains consuming mountains of grass. Day after day, year after year, they fattened themselves, turning tons of grass into pounds of meat. And when man killed a bison or an elephant he got a supply of nourishment and energy which it had taken many years to collect.

And they needed supplies. During snow storms and blizzards and in freezing weather, it was not possible to hunt for food. The good old days, when it was warm all the year round, were gone.

But one change brings on another. Once man began to store up supplies, he had to stay longer in one spot. He couldn't move so easily. For you can't drag a mammoth's carcass around with you.

There were other reasons, too, why man had to stop being a homeless wanderer. Formerly any tree would serve as a refuge for the night, to protect him from beasts of prey. Now he was not so afraid of beasts of prey. He had another enemy

—the cold, and he had to have a dependable shelter to protect him from this new enemy.

Man Builds a Second Nature

The time came at last when man set about building for himself his own little, warm world in the big, cold world.

At the entrance to a cave or under some overhanging cliff, he made for himself his little private sky of skins and branches, under which were neither rains nor snows nor wind. In the middle of his little world, he put a burning sun, which gave him light at night and heat in the winter.

On the sites of some ancient hunting settlements there are still to be seen holes into which were sunk the posts which supported this "heavenly vault"—the roof of the hut. And in the centre of the space enclosed by the poles, there are still charred stones which surrounded the fire, the artificial sun.

The walls have long since fallen down, gone to pieces, rotted away. But, although they are no longer in existence, it is possible to see exactly where they stood. The whole interior of the little world speaks of its creator—man.

Stone knives and scrapers, broken bits and flakes of stone, disjointed bones of animals, charcoal and ashes on the hearth—these things are all mixed in with the sand and clay in a way which is never found in nature which has been untouched by man.

Take but a few steps beyond these invisible walls of the dwelling which disappeared so long ago and you will find no traces of man's handiwork. There are no more implements in the ground, no charcoal and ashes of a bonfire, no bones.

So this second world created by man is still set off from everything around it as by an invisible line.

As we rummage about in the ground which has preserved traces of the work of human hands, look at the stone knives and scrapers, poke in the charcoal on the hearth where the fire died so long ago, we see clearly that the end of the previous world was not the end of the world for man, because man succeeded in creating his own little world.

CHAPTER V

A THOUSAND YEAR SCHOOL

First Trip to the Past

Two styles of stone implements, one large and one small, are commonly found in the camps of the bison and mammoth hunters.

The larger one is a heavy stone triangle, sharpened on both sides. The small one is a long, thin sliver forced from a larger piece of stone, with one edge sharpened.

Evidently each one of these implements had a special use, otherwise they would not have been so different.

How are we going to find out what they were used for? Of course, merely by looking at them we can tell something about it. Both of them are sharp. That means they were used for cutting or splitting. One is bigger and heavier than the other. That means it was intended for cruder work. From its looks you can see it would take a good deal of strength to use it.

But precisely what kind of work could it have been?

The best way to find out is to go back to the Stone Age and see how people worked with their stone implements.

In novels the author often says: "Let us go back ten years." That's all very well for novelists—they can go anywhere they wish in any way they please, and they may write anything they wish about their heroes. But how about us who are writing a true story? It's not a mere ten years or so we have to go back, but tens of thousands of years.

Nevertheless, we can go back to the Stone Age.

If you want to do this, you must first provide yourself with the things you will need for so long a voyage. First of all, you must get an expensive tent which can be put into a small bag along with its canvas floor some collapsible bamboo poles, pegs for fastening the tent ropes, and a hammer for driving the pegs into the ground. Besides the tent you'll need a whole stack of other things: a cork hat to protect your head from the sun, an axe, a kettle, a gasoline cook stove, a cup, a spoon, a compass, and a map. Put all these into your travelling bag and be sure to take a gun along with you. You can't live without hunting in the Stone Age. And now go to the nearest seaport and buy a steamer ticket.

Don't tell the ticket agent you're going to the Stone Age. If you do he will think you ought to

get a ticket for an insane asylum instead of a steamer.

On your ticket you won't find anything like: "To the Stone Age and Return." It will be just an ordinary steamer ticket and will say: "Tourist Class Ticket to Melbourne."

In a few weeks the steamer will get you to your desired destination. For, you see, there are people who still use stone implements—and these people live in Australia. That is, you may make a journey in space take the place of a journey in time. The steamer is just as good a time machine as the one Wells writes about.

There are in Australia people living who use stone implements, so we must go to them to find out how stone implements are used. Over dry desert plains, with patches of prickly bushes here and there, we make our way into the depths of the country, to the land of the Australian hunters. Under the trees along a river we shall see their huts, made of hides and branches.

Children play about the huts. Men and women are sitting on the ground working. An old man with shaggy hair and a long beard is skinning a kangaroo killed in the hunt. The old fellow is working with a triangular stone knife—the very same kind of big stone implement we took this long journey to see. Beside him a woman is cutting out a garment with a long, thin, sharpened piece of stone. Again we recognize a familiar article; precisely such long, narrow knives are found in Europe in the hunting camps of primitive man.

This does not mean that the present-day Australians are primitive people. Thousands of generations separate them from primitive people. These stone knives they are using are merely relics of the past which have been preserved, but these relics of the past can explain many things to us. As we watch these Australians work, we see, for instance, that the large, triangular knife is a man's tool, the tool of the hunter. They use it to kill their prey, to skin and cut up the carcass. The small knife is for the use of women, for domestic work. With it the women cut out the garments, cut straps, and scrape the leather.

Division of labour between the two implements tells of the division of labour among people which had already begun in the time of primitive man, while he still lived by hunting.

Work was becoming more complicated. In order to get it done more efficiently, one person had to do one thing, another person something else. While the men were tracking and pursuing their prey, the women were not sitting idle, but building huts, gathering roots, taking care of the supplies.

And there was another division of labour—that between the young and the old.

A Thousand Year School

To do any kind of work, one must first learn how to do it. And this knowledge doesn't come from heaven. One has to learn it from someone else.

If a carpenter had to invent an axe, a saw, and a plane himself, and, in addition, had to figure out how to work with these tools, there wouldn't be one carpenter in the world.

If, to learn geography, every one of us had to go all around the world, discover America again, explore Africa, climb to the top of Mt. Everest, and count all the capes and isthmuses in the world for ourselves, no one life would be long enough, even if it were a thousand times longer than it is.

The farther we progress, the more there is for people to learn. Each new generation receives from the preceding one a greater store of knowledge, information, discoveries.

Two hundred years ago people often became professors when they were only sixteen years old. Just try nowadays to become a professor at that age!

It takes a dozen years just to finish as far as high school. And in the future people will have to study still longer, for every year brings new discoveries in every science, and the number of sciences is growing all the time. Not long ago there was only one Physics. Now we have Geo-Physics and Astro-Physics. And there used to be only one Chemistry. Now we have Geo-Chemistry, Bio-Chemistry, and Agro-Chemistry. Under the impetus of new knowledge science keeps growing and multiplying like living cells.

In the Stone Age there were, naturally, no sciences. Man was just beginning to accumulate experiences and store them up. Man's work was not so complicated as it is today, so people didn't

have to spend much time learning. But they did have to study some, even then.

To track wild animals, to skin them, to build huts, to make stone knives—every one of these things required skill. And where were they to learn their technique?

Man does not come into the world a born craftsman. He learns to be one.

There we have a very clear example of how far man is removed from the animals. An animal gets by inheritance from his father and mother all his tools and the knowledge of how to use them, just as he inherits from them the colour of his fur and the shape of his body. Pigs don't have to learn how to root, because they are born with snouts for rooting. A rodent has no trouble gnawing and cutting down a tree for,' you see, his cutting tools grow right in his own mouth. So animals have no workshops and no schools. But man makes his own tools, he is not born with them. That means that he does not inherit from his father and mother the knowledge of how to use tools, but has to get it from teachers and from older people in the course of working.

I dare say lazy pupils would be very glad if people were born knowing grammatical rules and how to work examples in arithmetic. Then they wouldn't have to go to school. But it wouldn't be good for them at all. If there were no schools, people would never learn anything new. Human technique and human customs would be frozen at one level, like the technique and customs of a squirrel.

Fortunately for mankind, people are not born with ready-made habits. They study and learn, and every generation adds something to the common store of human experience. Experience grows and grows. Mankind keeps pushing farther and farther back the limitations to his knowledge.

Every schoolboy studies. And the whole of mankind goes to school also, learns more and more new things all the time. This is the Thousand Year School that has given man science and technique and art, has given him his whole civilization.

Man entered the Thousand Year School by the Stone Age. The old, experienced hunters taught the younger people the toilsome art of hunting, taught them to distinguish different tracks left by the animals on the ground; showed them how to creep up on their prey without scaring it away.

Hunting requires skill nowadays, too, though it is easier to be a hunter today; for one reason because the hunter doesn't have to make his own weapons. In the Stone Age hunters had to make their own weapons: clubs, knives, spear points. An old master had much to teach a young one.

Women's work also had to be learned. A woman had to be not only a housekeeper, but also an architect, a woodchopper, and a tailor.

In every tribe there were experienced old men and women who passed on the experiences of their long, laborious lives to the rising generation.

But—how did they pass their knowledge and their experience on to others? By showing and by telling, and for this they needed language.

An animal doesn't have to teach his young how to use his living tools—his paws and his teeth, so an animal doesn't need to know how to talk. But man had to learn to talk. Language was necessary to him, both for his work itself, and so that he could pass on his experience and skill from the older to the younger.

How did man talk in the Stone Age?

Second Trip to the Past

Let's go back to the past again. Only this time let's try to get along with a less complicated equipment, do it more simply. You don't have to take a ship to travel. You can do it just sitting at home.

When we turn the hand of the radio receiver, we are taken in a moment from New York to Paris, from Paris to Moscow, from Moscow to Bombay without leaving our own room. And if we have a television set, we cannot only hear, but also see the people in other cities and countries on the other side of mountains, over seas, and beyond oceans.

But how are we going to hear people from whom we are separated not by miles but by years and years and years?

Is there any means by which we can travel in time as we travel in the ether?

Yes, there is: Talking Pictures.

On the screen we can see the whole world, not only the world of the present, but also the world of the past. But a moving picture film is a ship which can carry us back only to the date when it

itself was built, only a few years ago. The first talking moving pictures appeared in 1927.

To continue our journey farther back into the past, we'll have to transfer from one ship to another, and each ship will be worse than the last; from steamer we get on a sailboat, from sailboat we transfer to a rowboat.

Take the silent movies. There we can see the past, but we can't hear it.

Take the phonograph; we can hear the voice, with every shade of its intonations, but we can't see the speaker.

And these ships, too, can take us only to those shores from which they took off. The movies cannot show us things that happened before 1895, and the phonograph takes us back only to 1877, the year it was invented.

Before that the voices all are stilled. They are preserved only in symbols, letters; in the straight, even lines of printed books.

In photographs, in old daguerreotypes, there are frozen smiles and expressions. Look in some old family album, and between the green satin covers, in the grip of metal clasps, you see the lives of several generations.

There, on the cardboard page is the faded photograph of a little girl, dressed as they used to dress children in the '70's. The girl is leaning on a picturesque garden fence, such as were found only in photographers' attics.

On the same page is a bride in a long veil, and her fat, bald groom in a frock coat. Their hands

rest stiffly in a niche in the marble column made for that purpose. Their wedding rings are in full view. The groom is at least thirty years older than the bride who has the same naive, frightened eyes as the little girl in the other photograph.

And here she is again, forty or fifty years later. You can hardly recognize her. Her forehead, under a black lace kerchief, is lined with wrinkles; her eyes have a look of weariness and resignation; her mouth has fallen in. On the back of the photograph is written, in a shaking hand: "To my dear grandchild from her loving grandmother."

A whole human life pictured on one page of a photograph album.

The farther back we go, the poorer photographs are ingiving the expression of the face, the pose of the head, the movements of the hand. Nowadays we can easily catch on our photographic films a rider in full gallop, a swimmer ploughing through the water. But in those days, when they wanted to photograph a person, they had to put him in a special chair with clips to hold his head and shoulders still. No wonder the picture came out looking more like that of a manikin than a human being

The year 1838—beyond this date there are no photographs. As we go further back into the past we shall have to depend on other witnesses, witnesses not so unprejudiced and accurate as a camera.

To reconstruct the past we have to listen to and compare the testimony of witnesses preserved for us in picture galleries, archives, and libraries.

So hundreds and hundreds of dates fly past us, like figures on mile posts. The year 1456. Before this date we find no printed books. The ornate flourishes of the scribes' handwriting take the place of the clear type of the printed page.

The copyist's goosefeather pen creeps slowly across the parchment and with it we weave our way into the past, step by step, letter by letter. From parchment to papyrus and inscriptions on the walls of temples our path leads us farther and farther back into the past.

The writings left us by these peoples of the past become ever more difficult to understand, more cryptic, as we delve deeper and deeper. Finally writing disappears. The voices of the past are completely silenced.

What lies beyond?

We look for traces of man in the ground. We dig in forgotten graves; we examine ancient implements, the stones of buildings long since fallen in ruins, the charcoal of fires long since quenched.

These relics of the past tell us how man lived and how he worked. But can they tell us how he talked and how he thought?

A Wordless Language

In the depths of caves in the hunting camps of primitive man, we often find man himself, rather what remains of him.

What kind of person was our hero after those hundreds of thousands of years which separated him from Pithecanthropus?

First of all, we must agree on what we are going to call him from now on for, as you know, the name of our hero changes from chapter to chapter. We shall call him as he is called in science: Neanderthal Man—from the name of the valley, Neanderthal, where the skull of a man who lived in the time of the mammoths was found.

We have to give our hero a new name for, you see, he has really become another person. His spine has straightened, his hands have become more flexible, his face has become more human.

Novelists are in the habit of describing in detail the outward appearance of their hero. And they're never chary of giving him plenty of good looks, either: his eyes are "glowing coals," his nose "aristocratic, aquiline," his hair black "as a crow's wing." But they never tell us about the size of his brain.

We're in a different situation. For us the size of the brain is of first importance and interests us much more than the expression of his eyes or the silvery tones of his voice.

Careful measurements of the skull of the Neanderthal Man show, without possibility of a doubt, that his brain was larger than that of Pithecanthropus.

Obviously those thousands of years of work were not in vain. They changed the whole man, especially his head and his hands. For it was his hands that had to do the work and his head had to give the orders.

As he fussed with his stone axe, gave new form to the stone, man was unconsciously changing him-

self and making over his own fingers, making them more dexterous and mobile. He was making over his brain, too, which was becoming more complex all the time.

When you look at the Neanderthal Man you know at once that he is not an ape.

Yet, how much he still resembles an ape!

His low forehead hangs over his eyes like the visor of a cap. His teeth stick out.

It is in his chin and his forehead that he is most different from modern man. His forehead recedes and he has hardly any chin.

In his skull with its very low forehead there were missing some parts of the brain of modern man. And the lower jaw, with chin slanting back, was not yet suitable for human speech.

A man with such a forehead and such a lower jaw could not think and talk as we do.

Yet he had to talk. Work in common made it a necessity. When people work together they have to agree about their work. Man could not wait until his forehead straightened up and his lower jaw got bigger. He would have to wait a thousand years for this.

How did man make himself understood?

He expressed himself as well as he could with his whole body. He did not yet have a specialized organ of speech, so he talked with his whole body, the muscles of his face talked, his shoulders talked, his legs talked, and most of all, his hands talked.

Did you ever carry on a conversation with a dog? When a dog wants to say something to his

master he gazes at him with his eyes, rubs him with his nose, puts his paws on his knees, wags his tail, and wriggles and whines with impatience. He cannot talk in words, so he has to talk with his whole body, from the tip of his nose to the tip of his tail.

Primitive man also could not talk with words, but he had hands which helped him express himself to others. You see, he did his work with his hands. His tongue was not used for work.

In place of saying "cut!" he made a gesture with his hands. In place of saying "give!" he stretched out his upturned palm. In place of saying "come here!" he made a gesture toward himself. And at the same time he helped his hands with his voice: he roared, groaned, and screamed to attract the attention of the person he was talking to, to make him look at the gestures he was making.

How do we know this?

Every bit of stone implement found in the ground is a bit of the past. But where are we to find bits of these gestures? How can we restore the movements of these hands which disintegrated so long ago?

This would be impossible if it were not for the fact that these primitive people were our ancestors and we, present-day people, have inherited something from them.

Gesture Pictures

A few years ago a North American Indian, of the Nez Perces tribe, made a visit to Europe. He didn't look at all like those Indians you read about

in Fenimore Cooper, armed with tomahawks. He didn't wear moccasins and he had no feathers on his head. He dressed just as we do and spoke both his own dialect and the English language perfectly.

But, besides these two languages, he also knew a third which had been preserved among the Indians from very ancient times.

This is the simplest language in the world. If you want to learn it, you won't have to bother studying all kinds of declensions and conjugations, learning about participles and prepositions and all those things that make so much trouble in our language. And you'll have no difficulty at all with pronunciation, because you won't have to pronounce anything. The language this visiting Indian could speak was not a language of sound but of gestures.

If you tried to make a dictionary of this language you'd get something like this:

A Page from the Dictionary of Gestures

Bow—One hand holds an imaginary bow, the other pulls back an imaginary bow-string.

Wigwam—A two sided, sloping roof, formed by clasping the fingers of both hands together.

White man—A gesture of the hand over the forehead, to suggest the brim of ,a hat.

Wolf—A hand with two fingers stretched forward, like two ears.

Rabbit—The same hand with two outstretched fingers and another gesture with the other hand

describing an arc. The two ears and the curved back of the rabbit.

Fish—Open hand, palm down, moving in zigzags through the air. This represents a fish which, when swimming, strikes with his tail, now to the right, now to the left.

Frog—Fingers of one hand curved inwards and downwards, the hand then jumping across the table.

Cloud—Both fists above the head, imitating a floating cloud.

Snow—Two fists, slowly separating and moving downwards, like fluttering snowflakes.

Rain—Two fists, separating and coming down fast.

Star—Two fingers held high above the head, now close together, now separating, representing the twinkling of a star.

Every sign is a picture, drawn by the hands in the air. Just as the oldest kind of writing was done not with letters but with pictures, so, perhaps, these old gestures also were gesture-pictures.

We don't mean to say that the present gesture language of these Indians is the same as that used by primitive people. In this gesture language are many words which could not possibly have been in the language of primitive people. For instance, the gestures which came into use very recently:

Automobile—Make a circular movement with the hands, imitating two wheels. Then make

a gesture of guiding the steering wheel of an automobile.

Train—The same two wheels, with a wave-like motion of the hands, imitating the smoke of the locomotive.

These are very recent gestures, but right alongside of them, we find in our gesture dictionary words which apparently have come down from primitive people. For example:

Fire—Wave-like movements of the hand upwards—the smoke rising from a bonfire.

Work—The open hand beats the air.

Who knows, perhaps primitive people also beat the air with the open hand when they wished to say "work."

Our Own Gesture Language

Gesture language is still in use today.

When we want to say "yes," we do not always say "yes." We often merely nod our heads.

When we want to say "there," or "in that direction," we often point with one finger. We even have a special name for the finger we use, the "pointer" finger.

When we greet one another, we bow. We shake our heads, shrug our shoulders, spread our hands out, frown, make a sucking noise with our lips, threaten with a finger, pound on the table, stamp on the floor, wave our hands, seize our heads, press our hands to our hearts, throw our arms about

each other, shake hands, throw kisses of good-bye.

There you have entire conversations without a single spoken word. This "language without words," the language of gesture, is reluctant to depart from the stage.

And it has its advantages. Sometimes with one gesture we can express more than with a whole speech. A good actor can, in half an hour, without uttering a single word, merely with his brows, his eyes, his lips, say more than with hundreds of words.

Of course, we should not abuse this language of gestures. It isn't worth while to express with our hands and feet what we can say with words. And, after all, we are not primitive people. To stamp our feet, stick out our tongues, point at people—these are habits which it would be better to get rid of.

But there are times when the "language without words" is indispensable.

Did you ever happen to see signals being sent from one ship to another with flags? What a loud voice it would take to be heard above those gusts of wind, the noise of the waves, and sometimes salvos of the guns in addition! In this case, the ear is useless to man and the eyes come to his aid.

You often use this "language without words" yourself. When, during class, you want to attract the attention of your teacher, you raise your hand. And you should. For no one could possibly study if thirty or forty people all talked at once.

So we find at the present time relics of the long forgotten past.

Evidently this "language without words" is not so poor since it has survived for so many thousands of years and is still necessary to people. It has survived among many peoples as a relic of the past.

Vocal language won out but it did not drive this earlier language completely from the field. The conquered became the servant of the conqueror.

It is not without significance that among many peoples it is preserved as the language of subjects, slaves, children.

In the Turkish and Armenian villages in the Caucasus it was the custom, not so very long ago, for women to communicate with signs as they were not allowed to speak to men outside their own families.

A sign language was found in Syria also and in several other places.

In Persia, for instance, servants at the court of the Shah had to talk by means of signs. One was allowed to speak only with one's equals. These unfortunate people were deprived of the right of "free speech" in the literal sense of the words.

Man Earns a Mind

Every wild animal in the forest is always listening and watching for signals that come to him from every direction. The scraping of a branch—perhaps an enemy is hiding there. Better run away or get ready for a fight.

A clap of thunder, the wind blows through the forest ripping the leaves from the trees. Better take refuge from the coming storm in one's nest or hole.

On the ground, along with the scent of decaying leaves and mushrooms, there is a faint scent of prey. Better follow this up and get that prey.

Every rustle, every scent, every track in the grass, every squeak or whistle means something, requires that something be done.

Primitive man also listened to the signals coming to him from the world about him. But he soon learned to understand other signals, too, signals which came to him from the other people of his tribe.

A hunter comes on the track of a deer. By a gesture of his hand he signals to the other hunters behind him. They have not seen the deer yet, but the signal tells them to get their weapons ready just as well as if they had actually seen his branching horns and pricked-up ears.

The track of the deer on the ground is one signal. The waving of the hand, telling about the track that has been found, is the signal of a signal.

Every time one of the hunters finds a track or hears a rustle of an animal hiding in the woods, he sends a signal about these signals to the other people of his band.

So these signals (of signals), which man gave man were combined with those signals sent man by nature.

Ivan Petrovich Pavlov, in one of his works, says that human speech is a "signal of signals."

At first there were only gestures and yells. These signals, received through the eyes and ears, were transmitted to the brain of man, as to a central telephone station. The brain, as soon as it got the "signal of a signal," such as "an animal is approaching," sent back a command: to the hands, to take a firm grip on the spear; to the eyes, to look sharply among the branches; to the ears, to listen attentively to the creaking of a branch or the rustle of leaves. The animal was not yet visible; they had not yet heard it; but man was all ready to meet it.

The more gestures there were—the oftener these "signals of signals" were sent to the brain—the more work there was for the "central station" which is situated in the frontal part of the human skull. And this made it necessary to enlarge the central station. New cells kept being formed in the brain. The connections between these cells became more and more complex. The brain grew, increased in size.

That's why the size of the brain of Neanderthal Man is greater than that of Pithecanthropus. The brain of man had developed. Man had learned to think.

When he saw or heard a signal which meant "the sun," he thought about the sun, although it might be the middle of the night.

When they signalled he must come and bring his spear along, he thought about his spear, although he didn't have it with him at the moment.

Working together taught men to talk, and in learning to talk, they learned to think also.

Man did not get his intelligence as a gift from nature; he earned it.

How the Tongue and the Hand Exchanged Roles

As long as there were very few tools and man's experience was not very great, the simplest gestures were sufficient for all practical purposes.

But the more complicated work got, the more complicated the gestures became, too. Everything had to have its own gesture and it had to describe and picture the thing it represented accurately.

So the picture-gesture came into being. Man drew in the air an animal, a weapon, a tree.

Suppose a man wants to describe a porcupine. He not only draws a porcupine, he, as it were, becomes for the moment a porcupine. He shows by gestures how the porcupine pricks up its ears, how it digs up the ground and throws it to one side with its paws, how it sticks out its bristles. To tell just any little thing required close observation such as only real artists possess nowadays.

When you say, "I drink water," no one can tell from what you say how you drink it; whether from a glass, a bottle, or the palm of your hand.

That was not the only way man talked when he expressed himself with his hands only. He put his cupped hand to his mouth and eagerly lapped up the imaginary water with his tongue. This showed that the water was good, that it quenched one's thirst.

We say merely, "to trap" or "to hunt." Primitive man described the whole scene of the hunt by his gestures.

Gesture language was at the same time both poor and rich. It was rich in that it was vivid, that it pictured clearly things and events. It was poor because while you could say either "right eye" or "left eye" by a gesture, it was much harder to say simply "eye."

You could accurately describe a thing by gestures, but it was utterly impossible to express an abstraction by any imaginable kind of gesture.

Gesture language had other shortcomings, too. You couldn't talk at night for no matter how wildly you waved your hands about in the dark, nobody would see them.

And even in the daytime it was not always possible to talk with gestures. Out on the open plain people could easily communicate by means of gestures, but in the woods, when the hunters were separated by a wall of trees, conversation was utterly impossible.

So man had to express himself by sounds.

At first the tongue and the throat didn't serve him very well. It was hard to distinguish one sound from another. Everything sounded like either a roar, a scream, or a whine. It was some time before man mastered his own tongue and made it articulate distinctly.

At first the tongue merely helped the hands. But as it learned to speak more clearly and distinctly, it began more often to take the role of first fiddle

in the orchestra. Audible speech moved up to first place.

The movements of the tongue in the mouth were the least noticeable of all the gestures of the body, but they had the great advantage of being heard.

At first audible speech was very like gesture language. It was also a picture, describing everything, every movement clearly and vividly.

In the language of the Yeve tribe, they do not say simply "to walk." They say: "zo dze dze," to walk firmly: "zo bocho bocho," to walk with a heavy step like a fat person; "zo boola boola," to walk fast, precipitately, not looking where you're going; "zo pia pia," to walk with short, mincing steps, "zo govu govu," to walk stooping over, with the head bent forward.

Every such expression is a word picture, accurately describing the act of walking down to the smallest details. There is simply a firm step, then there is the firm step of a lanky person, and the firm step of a person who walks without bending his legs.

There are as many expressions as there are different ways of walking.

The gesture-picture was supplemented by the word picture.

So man learned to talk—at first by means of gestures and later in words.

A River and Its Sources

What have we discovered in our trips into the past?

As a traveller who follows a river up stream discovers the river's sources, so we have reached that little rivulet from which the great river of human experience started.

There at its sources we have found the beginning of human society, the beginning of language, the beginning of thinking.

As a river gets wider and deeper with every tributary which brings its waters, so too, the river of human experience has kept on getting wider and deeper because every generation has brought to it all the experience it has gathered.

Generation after generation has passed away. Peoples and tribes have disappeared and left no traces, have been scattered in the dust, and left behind no monuments in the form of cities or villages.

It seemed that there was nothing that could withstand the all-destroying power of time. But human experience has not disappeared. Conquering time, it has continued to live in language, in technique, in science. Every word in a language, every movement in work, every concept in science—these are all the accumulated, combined experience of generations of men.

The work of these generations was not lost, just as the water of a tributary river is not lost when it flows into the main stream. In the river of human experience the work of people of long ago unites with the work of people who are living today, to form a single whole.

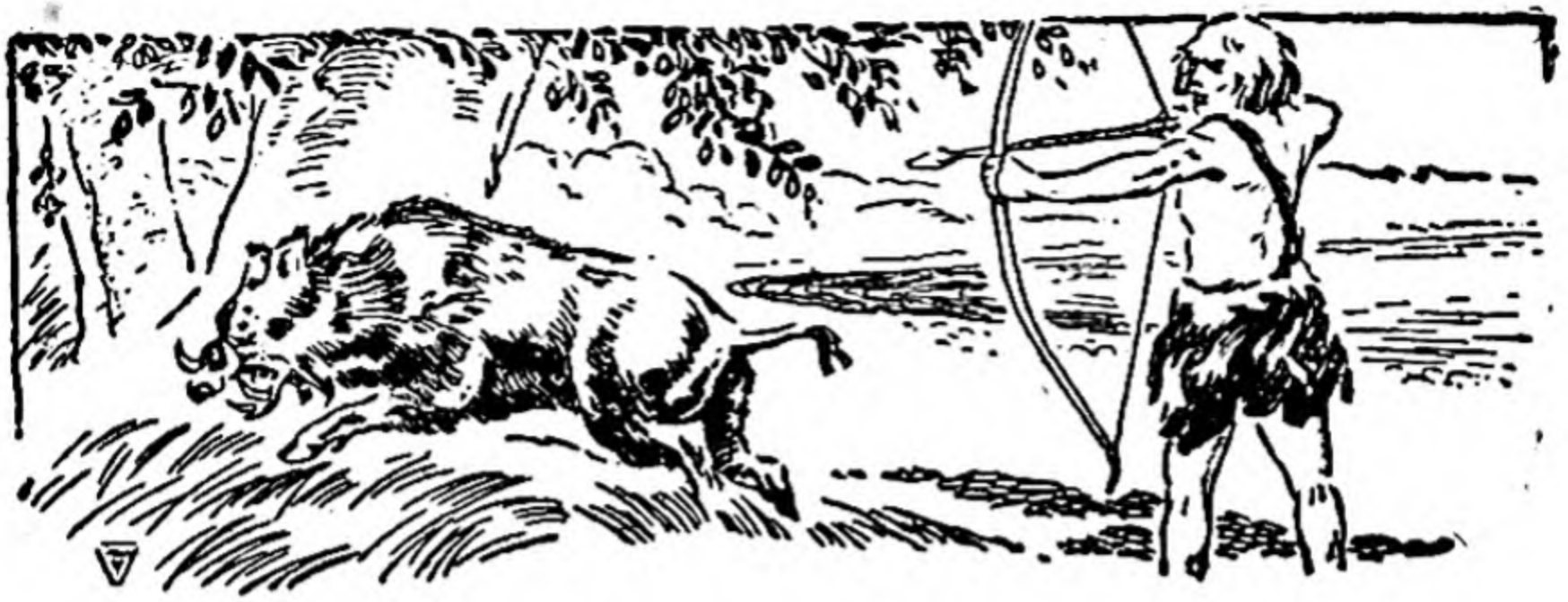
So we have reached the sources of the river, the beginning of all beginnings. So man came

into existence—a creature who works, talks, thinks.

As we look over the long line of the thousands of years that separate man from the ape, we cannot but recall those wise words spoken by Friedrich Engels, that "work created man."

PART TWO

THE GIANT AS A YOUNG MAN



CHAPTER I

IN A DESERTED HOUSE

When people move out of a house there are always a lot of things left in it which they have thrown away. Bits of paper clutter up the floors of the empty rooms, pieces of broken cups, old tin cans. Old battered saucepans are piled up on the cold cook stove. A chimneyless lamp looks drearily down on all this desolation. A rickety old arm-chair, clumps of red hair sticking out of its torn upholstery and one leg missing, sleeps a dreamless sleep at one side of the room. You could hardly tell, from looking at all this, how the people lived in this house.

And that's precisely the problem which faces the archaeologist. He is always the last person to visit a house. And this wouldn't be so bad if he could find the house still standing. But he usually arrives on the spot hundreds of years after its last inhabitant has left. In place of a house he finds only tumble down walls and remnants of the foundations. So he considers every bit of broken pottery a find, every scrap of anything a piece of good luck.

How much old houses can tell a person who understands their language!

Old towers with their disintegrating stone dress, walls overgrown with grass, have seen so many people, so many events!

But there are other houses, the oldest houses in the world, caves, which have seen still more in their time. For, you see, there are some caves where people lived fifteen thousand years ago!

Fortunately for us, mountains are lasting things, and the walls of caves don't crumble away so quickly as the walls of a building built by men.

Take one of these caves. It changed owners countless times. First it was inhabited by underground water. This water brought in clay and sand and gravel.

Then the water left and people settled in the cave. Crude, sharp pointed pieces of flint found in the clay tell us about them. With these sharp pointed implements, primitive people used to cut up carcasses, get the meat off the bones, break the bones open to get at the marrow in them. That is, people who came to this cave were already hunters.

Many years went by. The cave was abandoned by people. Other inhabitants came to live in it. Its walls are rubbed and polished. This was the work of the cave bear, scratching his hairy back against the stone walls of his home. And there he is himself—or rather his skull, with its wide forehead and narrow muzzle.

In the next stratum we again find remnants of a human dwelling: charcoal and ashes from the bon-

fire, disjointed bones, stone and bone implements. People had again lived in the cave. We do not see these people, but nevertheless we can tell many things about them. All we have to do is to look at the things they left behind them.

For the inexperienced eye these are merely broken bits and chips of stone, very little different from each other. But, if you look closely at them, you can see the future hammer, the future knife, and the future saw and awl. One implement has a sharp edge, like a knife, another a sharp end, a third has teeth along one edge.

There they are, the grandfathers of our tools. The very oldest of them is the hammer, a round stone sledge. With this sledge they broke up the stone, chopped off pieces, scales, of which they made their implements.

But where there is a hammer there should be an anvil.

If we root around thoroughly in the rubbish at the bottom of the cave, we shall find grandmother anvil, not far from grandfather hammer.

Grandfather hammer was made of stone.

Grandmother anvil was made of bone.

This "old woman with a bony leg" is a far cry from our present-day anvils, but just look at it closely and you will see that it did its work well. It is covered with marks of the hammer and scratches. Evidently the anvil stood up well when they were hammering out the tool.

What do these implements tell us?

They tell us that the new masters of the cave were far ahead of the first inhabitants. During the thousands of years which had passed, human labour had become more varied and more complicated.

Formerly there was just one kind of sharpened stone for all purposes. Now they cut with one tool, split with another, scraped with another, pounded with still another. That tool with a sharp point is an awl with which they made holes in the skin when they were sewing a garment. That one with teeth along the edge is a scraper with which they cut meat, scraped the skin. And that other one with the sharp edge is the point of a spear.

Evidently men worked more and took more pains with their work. Cold, severe weather had come on them. They had to think about making themselves clothes of bear skin, about having supplies of meat for winter, and about building warm shelters for themselves. One tool, no matter what it was, wouldn't do for all this work. They had to have a whole set of tools.

There in the home of our own grandfathers we find the grandfathers of all our tools.

But we find only those things which time has preserved. And time is a poor caretaker. It has kept for us only the most lasting, the very strongest —those made of stone and of bone.

All that was made of wood or skins has been destroyed by time. That's why the awl has come down to us but not the garment which they sewed with the aid of this awl. The stone spear point has

come down to us, but not the piece of wood to the end of which it was tied.

But let's go on with our search.

Excavations usually go from the top toward the bottom; they first take off the highest layers, then come to those lower and lower down—to the depths of the earth, to the depths of history. An archaeologist reads his book backward, as it were. He begins with the last chapter and ends with the first.

We have told our story the other way round. We began with the very lowest strata, with the first chapters of the history of the cave, and now we are coming up higher, getting nearer to our own time.

What happened next in the cave?

By studying the strata we see that people left the cave several times and returned to it several times. When there were no people in the cave, bears and hyenas occupied it. It was filled with clay and dust and pieces of stone fell into it from the roof of the cave. In the course of many years, when a human band again discovered it, there was nothing left to tell them of its former inhabitants.

Years went by, centuries, thousands and thousands of years. People built themselves homes under the open sky, stopped using those shelters nature offered them ready-made.

Only shepherds stayed in the cave for short periods of time, when they were pasturing their herds on the green slopes, or travellers caught unexpectedly in the mountains.

Finally we come to the last, the concluding chapter in the history of our cave. People again

came to it. But this time they came not to live in it but to find out how those people of long ago lived in it.

Excavating layer after layer, these explorers of the past read from the beginning to the end the whole history of the cave.

Comparing the implements, they traced how human skill grew from one generation to another, human experience enlarged. They saw that man's implements did not remain unchanged during those thousands of years, but became better and better all the time. The rudely sharpened axe was replaced by the sharp spear point, drills, awls made of thin flakes of flint. To the implements of stone, implements of bone and horn were added. Alongside the sledge which was intended for work only on stone, appeared tools for working on bone, skin, wood. From the same stone man made a chisel for cutting, he made a scraper for working up the skin, and a drill for drilling in wood. Man's artificial claws and teeth got sharper and more unlike in appearance.

A Long Arm

When man made a spear and tied a stone spear point on the end of it, he added to the length of his own arm.

And this made him stronger and bolder.

Formerly when a man happened to meet up with a bear he ran away from him, scared out of his wits. He didn't care to pit his strength against that of the hairy inhabitant of the cave. He got the best

of the little animals without any trouble, but didn't dare face a bear in single combat. He knew very well that you don't come off alive from the claws of a bear.

This was so until man took a spear into his hands. The spear gave him courage. Now he didn't run away when he saw a bear. On the contrary, he went right toward him to attack him.

Rising to his whole great height, the bear went at the hunter. But before his paws reached the man, a sharp point was driven into his hairy breast, for, you see, the spear was longer than the bear's legs.

The wounded bear, "kicking against the pricks," raged forward against the spear and this made the stone point sink deeper and deeper into his flesh. It was an unlucky thing for the hunter then if the wooden spear broke in his hands and the bear, clawing him underfoot, tore at his face and shoulder with claws and teeth.

But it didn't happen often that the bear got the better of man, for by this time man didn't go hunting alone. The whole band ran up when they heard his cries for help. From all sides people surrounded the bear and put an end to him with blows of their stone knives.

The spear gave man booty about which formerly he could not even have dreamed. There are still found in the caves store-rooms made of stone flagging, and in them are heaps of bear bones. Evidently hunting was good if people were able to put away stores of bear meat.

The spear would have answered all purposes if man had always had to do with such clumsy fellows as bears, but he had to hunt other animals, too, more nimble and swift.

As they wandered over the plain, the band would come across droves of wild horses and bison. They would creep up on them but at the first rustle, the drove would start up and be off like the wind.

Man's arms were still too short to hunt horses and bison.

Then hunting itself gave man a new, strong material—bone.

With a stone chisel he cut out of bone a light, sharp point. He tied this point to a short piece of wood and had a new weapon—a dart.

He couldn't throw the heavy spear at a running horse, but he could aim a dart, with its light bone point, and a dart could go far. So man's arm became longer. With a light weapon, a dart, he got a horse on the run before he could get away.

True, it was not so easy to hit a moving mark. One had to have a strong arm and a true eye.

A hunter learned from childhood how to aim a dart, and still it often happened, when he was hunting, that out of hundreds of darts, only a dozen or so would hit the mark.

Ages, thousands of years, passed. Droves of horses and herds of bison became rarer. Man had killed off not a few of them. More and more often the hunters came home empty handed. A new weapon had to be invented which would shoot farther. Man's arms had to be made still longer.

And man created a new weapon. He cut down a sapling, bent it into a bow, and strung it with a rawhide thong for a bowstring.

The hunter had a bow.

When he pulled the bowstring back slowly, it gathered and stored up energy from his taut muscles. Then, when he let it go, it gave, instantaneously, all this stored up energy to the arrow. And shooting into space, the arrow flew like a falcon after its prey.

The arrow flew much farther than the hand-thrown dart.

The arrow and the dart are as much alike as a sister and a brother, but the sister is a thousand years younger than her brother.

It took thousands of years for men to make an arrow. At first they used their darts with the bows, and then they had to make their bows big—as tall as a man.

So man made his short, weak arm longer and stronger. When he learned to make a sharp pointed weapon of reindeer horn or of the tusk of a mammoth, he turned the weapons of those animals against themselves. And man is the only creature in the world that has ever done that.

The hand that aimed the dart and loosed the bowstring was no ordinary hand. It was the hand of a giant.

And when the young giant went out hunting he tracked not one single animal, but whole herds of them.

A Living Waterfall

There is a steep, craggy precipice in a place called Solutré in France. At the foot of this precipice archaeologists have excavated a huge heap of bones. There are pieces of mammoth bones, bones of primitive cattle, and skulls of cave bears.

But the great majority of the bones are horses' bones. In places there are whole heaps of them several feet thick. Archaeologists reckon there must be the remains of hundreds of thousands of horses.

Where did this horse cemetery come from?

When they examined it, the scientists discovered that many of the bones were broken, dislocated, scorched. It was evident that they had been in the hands of some primitive cooks before they reached this pile. And, upon investigation, it turned out that this was not a horse cemetery after all, but a huge mound of kitchen scraps.

Such a big pile of rubbish could not accumulate in a single year. That means people lived in this locality for many years in succession.

But why was the rubbish heap in this particular spot? Is it likely that primitive hunters of the horses would have made their camp there instead of on some level place?

This must have been what happened: the hunters, when they saw a drove of horses on the plain, crept cautiously up on them, hiding in the bushes and high grass. Every hunter held several darts in his hands. Those in front signalled where the

The living river tumbled over the height like a waterfall

horses were, how many there were, and in what direction they were going.

A ring of hunters surrounded the drove and slowly closed in on them. The horses, which had at first looked like dark patches here and there on the plain, were now clearly visible. Their big heads, slender legs, the manes on their arched necks, their bodies covered with long, woolly hair, could be easily distinguished.

They took alarm, sensing an enemy, and got ready for flight. But it was too late. A cloud of darts flew at them like a flock of wingless birds with long beaks.

The darts sank into their sides, backs, necks. Where should they run? On three sides they were surrounded by the enemy. In this plain, which had suddenly come to life, there was only one way out, one exit. Wildly whinnying, the drove rushed toward this exit, to escape from the hunters. But that was just what the hunters wanted. They were chasing the drove in that direction, nearer and nearer to the precipice.

Maddened with fright, the horses rushed headlong, not seeing where they were going. Tails in the air, their flanks covered with foam, they rushed along like a living river. This stream ran toward the rising ground and suddenly—the precipice! The leaders of the drove were already at the brink and saw their danger. They reared on their hind legs, snorting, but could not stop. Behind them the others pressed on, and pushed them forward.

And the living river tumbled over the height like a waterfall, to become a heap of bloody dead bodies below.

The hunt was over. At the foot of the cliff fires were lighted. The old women divided the booty. It belonged to the whole band, but the bravest and cleverest hunters got the best pieces.

New People

When we look at the hour hand of a clock, it seems to us as if it is standing still. But when an hour or two have gone by, we are convinced that the hand has moved.

So it is in the life of people. We do not always observe the changes going on about us and in us. The hour hand of history seems to us to be standing still. And only after several years are we suddenly aware that the hand has moved and that we have moved with it and that everything about has become different.

If we, the people of today, cannot always see the new, then our ancestors, who lived tens of thousands of years ago, were entirely incapable of it.

We have diaries, photographs, papers, and books to compare the old with the new. Our ancestors didn't have any means of comparison at all. Life seemed to them motionless, unchangeable. For it is as impossible to observe change without comparing the old with the new as it is to observe the movement of the hands on the face of a clock where there are no figures.

Every craftsman, when he made his stone implement, tried to imitate exactly all the movements and methods of the person who had taught him how to work.

When they were building their houses, the women laid the hearth stones exactly as their grandmothers had laid them. Hunters hunted wild beasts according to the rules left by custom.

Still, unconsciously, people did change both their implements, their dwellings, and their work.

Every new implement was at first very like the older one. The first dart was very little different from the spear. The first arrow was very like a dart. But the arrow and the spear were already two different things. And hunting with bow and arrows was not by any means the same thing as hunting with a spear.

It was not only the implements of man that changed. Man himself changed too. This is evident from the skeletons which are found in excavations. If you compare the man who used the cave first with the one who left it at the end of the ice age, you can see that these were two different beings. Neanderthal Man went into the cave still suggesting his ape ancestry. His back was bent, he walked clumsily, his face had scarcely any forehead or chin. Cro-Magnon Man was full grown and erect, very little different in appearance from us.

The difference is so great that some archaeologists have figured that they are in fact two different beings. They maintain that Cro-Magnon men came from some place far away and drove out the

former inhabitants, wiped them from the face of the earth.

That is the theory some archaeologists have held and apparently it is impossible to convince the upholders of this theory that the Cro-Magnon men were the former Neanderthal Men.

First Chapter in the History of the House

As man changed, his dwelling changed, too.

If we should write a history of the house, we would begin with the cave. Man did not build this house. He found it. It was made by nature itself.

But nature is a poor house builder. When she moved mountains and made caves in them, she did not care whether someone was going to live in the caves or not. Therefore, when people looked for a cave for themselves they were rarely able to find one which just suited them. The ceilings in the apartment were too high, or the walls threatened to tumble down, or the door was so low one had to creep into it on all fours.

The whole band set to work to put the cave into shape. They scraped the floor and the walls and levelled them with stone scrapers and bunches of branches woven together.

Not far from the entrance they dug a ditch for the hearth and lined it with flagstones. The women got busy making beds for the children. To make a bed they dug a ditch in the ground and put warm ashes from the fire in it instead of a feather bed.

Off in some out-of-the-way corner they made a pantry for the bear meat and other supplies.

So they fixed up the cave made by nature, and turned it, by their work, into a dwelling.

As time went on they took more and more trouble in the arrangement of their dwelling. When they found a natural awning, made by an overhanging cliff, they built walls up to it. If they found walls, they made a roof over them.

One of these primitive dwellings is preserved in the mountains of southern France. The local inhabitants have given it the strange name of "Devil's Fireplace." They thought only a devil could have warmed himself at a hearth in this huge, rocky lair. If they had been better acquainted with the story of their own ancestors, they would have known that the "Devil's Fireplace" was not made by a devil, but by human hands.

Here once upon a time primitive people found, under an overhanging cliff, two walls formed by broken rock which had fallen from the cliff. They built two more walls. One was made of big flat flagstones, the other by woven branches covered with skins. We can only guess about this wall, because it has been completely destroyed by time.

These walls enclosed a dirt hut—a big dugout. At the bottom of this dugout chippings of flint and bone and horn implements have been preserved.

This "Devil's Fireplace" is half house, half cave. It was not so very far from it to a real house.

Once man had learned to build two walls, it wasn't long until he learned to build four of them.

And, sure enough, we find the first houses under the open sky. These houses are more like

holes than present-day houses. Primitive men dug a big, deep cellar in the ground—a dugout. To keep the walls from falling, they strengthened them with stone and big mammoth bones. To protect it from the snow and the wind, they made a bowl-shaped roof of bent poles interwoven with branches and plastered over with earth.

It was an odd-looking house. From the outside only the roof was visible, looking like a little, round mound. The only entrance was through the "smoke stack," for the only opening was a hole in the roof through which the smoke escaped.

For benches, they put the jaw bones of mammoths along the dirt walls. And mother earth served them as a bed; they smoothed and tramped down a four-cornered square on the ground, and used a piece of wood for a bolster.

In this house, with bone benches and dirt beds, the tables were of stones. In the lightest place, close beside the hearth, they fixed up a work table of flat stone flags. Implements, bits of material, unfinished articles, are still to be found on a work-table like this. Scattered about on the table are bone beads, some of them finished, polished and pierced; others only partly finished. The workman had cut notches in a long piece of bone, but hadn't finished getting out the pieces for the beads. Something interrupted his work and made the people leave their dwelling. Evidently the danger was very great; otherwise they would not have left behind them those spear points of such artistic workmanship, those bone needles, with eyes punch-

ed in them, and those flint cutting tools for all kinds of work.

It was no easy matter to make these things. Many an hour's work had been spent on every one of them. Take, for instance, a bone needle, the first needle in the history of mankind. It looks like a little thing, but it required the greatest skill to make it. In one settlement they found a work-shop for the manufacture of bone needles, with complete equipment, raw materials, and partly finished products. Everything was preserved in perfect order. You could start manufacturing again tomorrow if there were a demand for bone needles. But it's doubtful if we could find workmen at the present time who understand this kind of work.

This is the way they made needles: with a cutting tool they cut out a little, round stick of rabbit bone; then, they sharpened it at one end with a piece of flat stone with a toothed edge; next, they pierced a hole in the other end with a sharp pointed bit of stone; and finally, they polished the needle on a stone flag.

See how many tools and how much work was necessary to make just one needle!

Not every band had workers so highly skilled as to be able to make needles so a bone needle became one of their most precious treasures.

Let us take a look into the lair of some primitive hunters.

There in the midst of the snowy plain are several little mounds, with smoke rising from them.

We approach one and creep into the hut through the opening in the roof, paying no attention to the smoke that makes our eyes smart.

We'll suppose we have put on an "invisible cap" so no one can see us. In the dugout it is smoky, dark, and noisy. There are at least ten grown people and still more children.

When our eyes have got used to the smoke, we can make out the faces and bodies of the people better. There's nothing of the ape left in these people. They are tall, well built, and strong. They have wide faces with eyes set close together. Their dark bodies are decorated with designs put on with red paint.

Sitting on the floor, the women are sewing on garments of skin. The children are tumbling about playing with the bone of a horse's leg or a deer's horn for lack of other playthings.

Beside the fire a worker sits cross-legged on a bench made of flagstones. He is fastening a bone point to a wooden dart. Besides him sits another workman, carving some kind of picture on a flat piece of bone.

Let's go nearer and see what he is drawing, or rather scratching.

With a few slender strokes he draws the figure of a grazing horse on the slab of bone. With amazing skill and patience, he makes the graceful legs, the outstretched neck with its short mane, the big head. The horse seems alive. It looks as if it is just about to take a step. You'd think the artist must be looking right at the horse to see how

well he catches the movement of the legs and the turn of the head.

The picture of the horse is finished, but the artist goes on drawing. He makes two or three diagonal strokes across the horse. And a strange sketch begins to appear. What can this primitive master be doing? Why is he spoiling the picture which might be envied by any artist of our own time?

The sketch gets more complicated. At last, to our great astonishment, we see the outline of a hut on the horse's body. Alongside this hut the artist makes two or three more, a regular settlement.

What is the meaning of this strange drawing?

Is it just chance, the caprice of an artist?

No, in the caves of primitive people we could make a whole collection of such strange pictures.

Here is a mammoth on which two huts are pictured; here a bison with three huts on it. And here is an entire scene: in the middle of the picture the carcass of a bison, half eaten; only his head, his spine, and his legs are left. The hairy head, with curved proboscis, lies between the front feet. Two rows of people stand alongside him.

Many such puzzling drawings, representing animals, people, and dwellings, have been preserved both on slabs of bone and flagstones, and on the sides of cliffs. But most of them are on the walls of caves. When we were making our excavations in the cave, we did not find any drawings on its walls. But, you see, we were only at the very en-

trance to the cave, there where people ate, slept, and worked.

Let's go back into the cave and examine all its nooks and winding passages, pry into the clefts in the rock which go back into the cliff sometimes a few dozen feet, sometimes several hundred..

An Underground Picture Gallery

We must take a lantern with us when we explore the cave. And as we go along we must be sure to remember every turn, every crossroad. It's an easy thing to get lost in an underground labyrinth.

The craggy corridor gets narrower and narrower. Water drops from the vaulted ceiling. Holding our lantern high, we carefully examine the walls.

Underground streams have decorated the cave with glistening crystal, but the hand of man has not worked here.

We go on. And suddenly someone calls out, "Look here!"

There is a bison drawn on the wall with black and red paint. He has fallen down on his front legs. Darts have landed in his curved back.

We stand for a long time looking at the work of the artist who worked here tens of thousands of years ago.

A little farther on we discover another drawing. Some kind of monster is dancing on the wall—a man who looks like an animal or an animal who looks like a man. The monster has a beard and on his head are long, curved horns. There is a

hump on his back and he has a bushy tail. His hands and legs are human and he holds a bow in his hands.

Upon close examination of the picture we see that this is a man wearing a bison's skin.

Beyond this picture there is another, a third, a fourth....

What strange kind of picture gallery is this?

In these days artists work in well-lighted studios. We hang their pictures in museums in such a way that they will be well lighted.

What in the world induced primitive man to put an exhibition of pictures in a dark cellar so far from human eyes?

It is evident that he didn't make his pictures to be looked at.

But why did the primitive artist paint them then? What do these, for us, incomprehensible figures of dancers in animal masks mean?

A Riddle and the Answer

"Several hunters take part in the dance. Each one has on his head the skin of a bison's head or a mask with horns made to resemble one. Each native holds a bow or a spear in his hands. The dancers represent a bison hunt. When one of them gets tired, he acts as if he is going to fall down. Then another one shoots a blunt arrow at him. They drag him out of the circle by the legs and flourish knives over his body. Then they let him go and another man, wearing a bison mask, takes his place in the circle. Sometimes the dance lasts

Upon examination we see that this is a man wearing a bison's skin

for two or three weeks without a moment's pause."

That is what they tell us about the primitive hunting dance.

But who could have seen it and where?

Quite accidentally we found, in the notes of a contemporary traveller, this description of that very hunters' dance pictured on the cave walls by the primitive artist.

This traveller saw it on the plains of North America, where the Indian tribes in this locality have preserved to this day the customs of the ancient hunters.

We have found the clue to the meaning of the drawing which so puzzled us, but the answer itself raises another question.

What kind of weird dance is this which lasts for weeks?

With us dancing is either an amusement or an art. But it is hard to imagine that the Indians dance until they drop, for three weeks on end, merely for the love of the art or to amuse themselves. And the dance itself is more like some kind of religious ceremony than a dance.

With us a dancing master directs the dancing. With the Indians a magician directed them. The dancers moved in whatever direction the magician blew the smoke from his pipe—following the track of an imaginary prey. By blowing his smoke now in one direction, now in another, the magician made the dancers move now toward the north, now to east, now to the south, now to the west.

And if the dance is directed by the magician, this means it is not a dance, but a magical ceremony, a sorcery.

The dancers, with their strange movements, are trying to charm the bison, to call him from the prairie by the mystic power of sorcery.

So that's what the dancing man pictured on the wall of the cave means! He is not simply a dancer, but rather a man who is performing a magical ceremony. And the artist who went into a cellar to draw by the light of torches, was not merely an artist, he was also a magician.

By picturing the hunters in the masks of wild beasts and as wounded bison, he is working a charm to make their hunting lucky.

And he firmly believes that the dance will help. This seems wild and senseless to us.

When we are going to build a house, we don't dance, imitating the movements of the masons and carpenters. If a teacher in school should take it into his head to dance for his pupils with a ruler in hands, we should send him straight to an insane asylum. But what seems madness to us was a serious business to our ancestors.

We have solved the puzzle of one of the drawings. We have found out why the dancing man was pictured on the wall of the cave. But we saw other pictures, too, no less puzzling.

Remember, we found in the cave a whole story, scratched with a sharp tool on a slab of bone. In the midst of the dancers was the carcass of a bison

with hunters around it. All of the carcass except the head and forelegs had been eaten.

What does this drawing mean?

This time we shall not go to America to find the solution. We shall go to the far north of Russia.

In Siberia they still recall the time when hunters, when they had killed a bear, had a "Bear Celebration." They took the bear into the house and ceremoniously placed him in the most honoured place. They put his head between his paws and in front of his head set several little images of deer, made of bread of birchbark. These were offerings brought to the bear. They decorated his snout with little cups of birchbark and put pieces of money on his eyes. Then the hunters went up to him and kissed him on the snout.

This was only the beginning of the celebration which lasted for several days, or rather nights. Every night they gathered about the remnants of the bear, bowed low to him and began to dance, imitating the clumsy gait of a bear.

After the singing and dancing were over they feasted—ate the meat of the bear, leaving his head and forepaws untouched.

Now we understand what the drawing on the bone slab means. It is a "Bison Celebration," a dance like the Buffalo Dance. The people surrounding the bison (the European buffalo) are thanking him for giving them his meat and begging him to continue to be gracious to them in the future.

If we go back again to the Indians, we shall find the same kind of hunting celebrations among them.

Among the Huichols the hunters place the body of a deer they have killed so that his legs face the East. In front of his mouth they put a cup with all kinds of food in it. The hunters go up to the deer, one after another, stroke him with their right hand from head to tail, thanking him for having allowed them to kill him.

"Rest in Peace, Big Brother !" they say as they do this.

The wizard, turning toward the deer, says:

"You gave us your horns and for this we give you our thanks !"

CHAPTER II

A TALK WITH OUR ANCESTORS

"Wondrous things are there; there the woodgoblin roams"

When we were children we all read fairy tales about princes, about the Sleeping Beauty, and the Arabian Nights; about animals which were turned into people, and people who, when they wanted to, could turn themselves into animals.

If we believe these tales, the whole world is inhabited by mysterious beings, good and bad, visible and invisible. In this world one has to be on guard all the time to keep from calling down the curse of some evil sorcerer or wicked witch.

One can't trust one's own eyes; an ugly frog may at any moment turn out to be a beautiful princess, or a handsome young man change into a terrible snake. Everything goes according to its own individual laws; the dead come to life, heads that have been cut off talk, people who have been drowned lure fishermen into the water.

While we are reading the fairy tale we almost believe all this. But as soon as we have closed the

book we come back immediately to the real world, where there are no wizards and no witches, where everything is governed by natural law. No matter how fascinating the fairy tale, we should hardly want to live in a fairy world, in which reason is powerless, where one has to be born lucky to escape these spells and enchantments.

But that is just what the world seemed like to our ancestors. They did not distinguish the imaginary from the real world. They thought everything happened according to the good or bad whims of unseen powers which directed the world.

When we stumble over a stone and fall, we blame our own carelessness. Primitive man would not have blamed himself, but some evil spirit which had put the stone in his way.

When a man dies from a knife wound, we say: he died from a knife wound. Primitive man would have said something quite different; the man died because the dagger with which he was stabbed was bewitched.

Of course, there are people even today who think illnesses can be caused by an "evil eye," that it's better not to begin anything on Friday, that it's bad luck if a rabbit runs across the road in front of you.

We laugh at such people. It's inexcusable to be superstitious today.

But we should not blame our ancestors for believing in witches and spirits. They were honestly trying to explain what went on about them, but

they knew too little to be able to find the correct explanation.

There are still tribes, not yet reached by civilization, who are like that.

The True Story of the Missionary, the Goat, and the Picture of Queen Victoria

Once an epidemic broke out among the people of a tribe in New Guinea, the Motu-Motus. People died one after another. There were groans and tears in every house. The entire tribe was terrified.

Where could such a terrible pestilence have come from?

They pondered over it, and thought about it, and at last they remembered that the illness had started after the arrival of some white people, a missionary and his family. When they came the illness came.

This idea seemed the correct explanation to them. So the natives, armed with spears and boomerangs, went in a mob to the missionary's house. They surrounded it and began to yell, "Death to the whites! They have put an evil spell on us. They have brought us sickness!"

The missionary, pale and frightened, came to the door, "Dear brothers and sisters . . . ." he began.

But his voice was drowned by their wild yells. He had a hard time getting them to listen to him. Never before in his life had the poor missionary been so eloquent. The speech he made to these natives surpassed in vividness of images and persua-

siveness of argument all the sermons he had ever delivered. For when he was preaching his sermons, he was trying to save other people's souls; this time it was his own life that was at stake.

The yells died down. The natives began to listen. He had gained time, but the situation was still precarious. Suddenly, luckily for the missionary, a goat appeared behind the garden fence. It stood staring at the crowd; the crowd stared back at the goat. There was a hush. The minds of the natives began to work again.

The goat came at the same time as the man and the plague. Maybe it was the goat that brought on the disease!

Someone called out, "Kill the goat! He's the one to blame!"

The fate of the goat was sealed. Dozens of hands broke down the garden fence. The missionary looked on silently and made no move to save his goat. When they had finished off the poor beast with their spears, the crowd left with joyful cries of triumph.

A few days passed. But, though due punishment had been dealt out to the criminal goat, the epidemic did not abate. They began to look about again for the cause. They remembered that the missionary had brought along two more goats, in addition to the ram they had killed.

So they gathered around his house again and demanded that he hand these two bearded criminals over to them. This time the missionary decided to resist; today, they ask for the goats, tomorrow

they'll be asking for my cow, and who knows what else?

So he absolutely refused to hand over the goats. He was willing to swear they were entirely innocent.

Well, then, who was to blame?

Some of the crowd around the missionary's house happened to look through the window and see a picture hanging on the wall in the dining room. It was of a woman in a rich evening dress, her shoulders bare, her chest decorated with stars, and a little crown perched on the top of her head. It was a picture of Queen Victoria, who was the queen of England at that time.

Such pictures, reproduced in thousands of copies, hung in every tavern and shop in London, but here in the land of the Motu-Motus a picture of a queen was a rare novelty.

All the natives stared at the picture. Now everything was clear to them; the picture was the culprit! It was that picture that had brought so terrible a misfortune to the tribe of Motu-Motus.

They began to shout again. Waving their spears, they rushed into the house. We don't know just how it all ended. Maybe the natives were satisfied with the picture of the English queen. Maybe they directed their wrath against something else they had never seen before: the missionary's bedroom slippers, a china coffee pot decorated with pink roses, or the clock up there on the wall that swung its pendulum so ominously.

The details are not important. We tell this true story merely to show how people who do not understand the laws of nature grope and guess at the reasons behind events.

People learn by experience that everything in the world is linked together. But not knowing the casual connection, they come to believe in some magic, supernatural powers that certain things have over other things.

This is a story told by Levy Brul, a French scientist, who travelled in Africa: "In Loango all the people living along the seashore would get excited at the sight of a sailboat with unusual rigging or a steamer with more smoke stacks than usual. A waterproof raincoat, a strange looking hat, a rocking chair, any new implement aroused the greatest suspicion among the natives."

That is, every unusual thing seemed to these natives an instrument of magic.

To protect one's self from the curse, one must wear a talisman, some kind of necklace made of crocodile's teeth, or a bracelet made of the hairs from an elephant's tail. A talisman is a guardian which wards off harm from the person wearing it.

Primitive people did not know any more about the world than the natives of Loango. And evidently they believed in magic, in witchcraft, incantations. The talismans found in excavations prove this, and so do the magic drawings in the depths of the caves.

What our Ancestors Thought About the World

It would be hard for a person to get along in the world if he didn't know any of its laws. He would feel weak and helpless in the power of unseen forces. Anything, according to his idea, might turn out to be a talisman, any man a wizard. Everywhere, restless, avenging spirits of the dead might be prowling about, ready to fall upon the living. Every wild animal, killed in the hunt, might come back to avenge its death. To ward off harm they would have to beg, entreat, try to propitiate these spirits all the time—give them gifts and pray to them.

Ignorance begets fear.

And since man was ignorant, he did not act like the master of the world, but like a scared, miserable supplicant.

As a matter of fact, it was still too early for him to consider himself as master of nature. He had become stronger than all the other animals in the world, he had conquered the mammoth, but he was still a very weak creature in comparison with the mighty forces of nature which he did not know how to direct.

One unlucky hunt might doom him to weeks of hunger. One blizzard might bury his hunting camps in the snow.

What gave man the power to struggle against nature and little by little, step by step, arrive at its conquest?

The thing that gave him this power was the fact that he was not alone.

Banded together in a group, people fought against the hostile forces of nature. They worked as a group and in the course of their work together they accumulated and stored up experience and knowledge.

True, they themselves did not know they were doing this, or rather, they knew it in their own way.

They had no conception of what human society was, but they felt that they were bound together, that people of one community were one big, many-handed person.

What bound them together? They were bound by kinship. For, you see, they lived in tribes; the children lived with their mothers, and their children, in turn, continued to live with their brothers and sisters, with their uncles and aunts, with their mothers and grandmothers.

This was the origin of the tribe.

Society for primitive hunting man was the tribe which was descended from common ancestors. People were all bound together by their ancestors. Their ancestors taught them to hunt and to make tools; their ancestors gave them dwellings and fire.

To work and to hunt—this meant to carry out the will of one's ancestors. Anyone who obeyed his ancestors would ward off evil and danger. Ancestors lived with their descendants. Invisible, they joined the hunt and the home life. They knew everything and saw everything. They punished the wicked and rewarded the good.

So, common work for the common good became, in the mind of primitive man, simply obedience, the fulfilment of the will of a common ancestor.

And primitive man did not have the sáme idea about work we have. According to us it is the hunting that provides food for the bison hunter. The primitive hunter thought that it was the bison who fed him. We do something like that, as a hang-over from the past, when we say that a cow "gives" us milk when we take it from her without asking her permission.

The primitive hunter thought of a wild animal, a bison, mammoth, or bear, as a benefactor. According to him it was not the hunter who killed the animal, but the animal who gave his meat and his skin to the hunter. Indians believe that they cannot kill a wild animal against his will. If a bison is killed it is only because he gives himself as an offering to them, is willing to be killed.

The bison is the benefactor and protector of the tribe. So in the minds of primitive people, still hazy about the world about them, these two ideas gradually became one, an ancestor protector and an animal protector who fed the tribe.

"We are children of the bison," the hunters say. And they really believe that their ancestor was a bison. When the primitive artists drew a bison and put three huts on him, this meant, "Camp of the children of the bison."

Man was connected with the wild animals in his work, and he could not conceive of any connec-

tion except one of birth, kinship. When he killed a wild animal, he begged his forgiveness, addressing him as his older brother. He put on the animal's skin and imitated his movements.

Man did not yet call himself "I." He felt himself a part, a tool of the tribe. Every tribe had its name, its totem. It was always the name of an animal which was the ancestor and benefactor of the tribe. One tribe would be called "Bison," another "Bear," a third "Deer." They regarded the customs of the tribe as commands of the totem and the commands of the totem were law for them.

A Talk with Our Ancestors

Let's go into the cave of primitive man again and sit down with him by the fire and have a talk with him about his beliefs and customs. Let him tell us himself whether our guesses are correct or not, whether we have rightly understood those drawings which he left on the walls of his caves, on talismans of bone and horn, as if on purpose for us.

But how shall we get the master of the cave to talk?

Long since the wind scattered the ashes of his hearth. Long ago the bones of the people who used to work here by the fire, making tools of flint and horn, sewing garments of skin, have rotted away. Only rarely do we succeed in finding a dry, yellowed skull in the ground.

What shall we do to make the skull talk?

When we were making our excavations in the cave, we found pieces and broken bits of tools from which we could reconstruct those tools and understand how man used them.

But where shall we find the remnants, the bits of their ancient speech ?

We must look for them in the languages which are spoken today.

For these excavations we don't need a spade; we don't have to dig in the ground but in the dictionary. Every word which a language keeps is a precious remnant of the past. It could not be otherwise, for it is through language that hundreds and thousands of generations have come down to us.

It looks simple enough to study a language, to do research work in it; as though all you have to do is to sit down at a table and delve into a dictionary.

But that is not the way it is done.

In hunting for ancient words investigators travel about the world, climb mountains, cross oceans. Sometimes in a little nation living behind the high walls of a moutain, you may find ancient words which have been lost in other languages.

Every language is like a settlement along the road of mankind. The languages of the hunting tribes of Australia, Africa, and America are like camps with which we have been acquainted for a long time. So the explorers cross the ocean to seek somewhere in the Polynesians for old meanings and expressions we have forgotten.

In their hunt for words the explorers go both to the deserts of the South and to the tundras of the North.

Among the nationalities of the Far North there are languages in which there are still some words from the time when they had no conception of individuality, when people did not know what such an expression as "my weapon," or "my house" meant.

It is in such languages we must delve to dig up remnants of ancient speech, just as archaeologists dig in the old settlements for remnants of dwellings and tools.

Of course, not everyone can be an archaeologist of the dictionary. Without a long preparation, without scientific knowledge, you would get nowhere. For old words are not preserved in a language as articles are in a museum. In the course of ages, words have changed many times. They have gone from language to language, they have grown one out of the other, they have changed their prefixes and their suffixes. Sometimes only the old root of a word is left, like the root of a tree that has been burned down. And it is only from this root that we can find out where the word came from.

In the course of thousands of years not only the forms of words changed, their meanings changed too. It often happened that an old word got a new meaning.

It's the same today. When a new thing is invented we do not always think up a new name for

it. We take an old word and attach it to the new thing, like a label.

Take the word quill for pen, for instance. It is the same as the word for feather because, many years ago, feathers were used as pens. A steam *hammer* is not in the least like a hammer in looks. The word for *sharpshooter* in Russian is *bowman*—but the present-day sharpshooter shoots bullets, not arrows, and he fires them from a rifle, not from a bow.

Manuscripts are often written on a machine, instead of by hand, as the word would indicate. And, when it was invented, the name of the machine was "writing machine," though it printed and did not write.

We have taken the old word "quill," and many other words, and applied them to new things.

All this has happened in recent times, in the very uppermost layers of our language, so it is easy for us to find the former meanings of such words. But if you delve deeper the word gets harder. One has to be a great specialist in languages in order to find the lost meaning of a word.

Marr was such a specialist. From a study of the languages of ancient and modern nationalities, he showed that many of our words formerly had quite different meanings. He found that in several languages the word "horse" meant "reindeer" and "dog," because people rode on reindeer and on dogs before they rode on horses. He found that in some languages "wheat" was formerly called

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"acorns," because the people ate acorns before they began to grow grain.

There are languages in which a lion is called a "big dog" and a fox a "little dog." This is because the word "dog" appeared earlier than the words "lion" or "fox."

Fragments of Ancient Speech

By excavating in languages, explorers have found remnants of the most ancient spoken language. Meschaninov tells us about these remnants in one of his books.

For example, in the language of the Youkagirs there is a word which, if it is literally translated means, "man-reindeer-kill." It is hard even to pronounce so long a word, and still harder to understand it.

One cannot tell who killed whom: the man the reindeer, or the reindeer the man, or the man and the reindeer killed a third person, or some third person killed the man and the reindeer.

But a Youkagir understands this word. He uses it when he wants to say, "A man killed a reindeer."

How did they happen to make so strange a word?

It came into being at a time when man still did not call himself "I," when he was not conscious that it was he himself who worked, hunted, tracked down and killed the reindeer. He thought it was not he who killed the reindeer, not even his tribe, but a mystic, unseen something. Man still felt

very weak and helpless in the face of nature. Nature did not obey him.

Today, by the wish of some incomprehensible powers, "man-reindeer-kill" very successfully. Tomorrow the hunting might be unlucky and they would return home with empty hands.

In the expression "man-reindeer-kill" there is no active agent. And how could primitive man understand who was the active agent, himself or the reindeer? You see, he thought the reindeer was given to man by an unseen benefactor—the ancestor of both himself and the reindeer.

As in our excavations, we come on down from the oldest layers of spoken speech to the more recent ones, we shall still find remnants of the speech of those times when man regarded himself as an instrument in the hands of mysterious forces.

Here is a sentence in the language of the Chukots,

"By man meat gives dog."

This sentence is unintelligible to us. We have dug it up out of that layer of speech which was laid down in the language a very long time ago when man thought quite differently from us.

In place of saying, "the man gives meat to his dog," they said, "By the man meat gives to his dog."

Who is it gives the meat by means of the man?

It is some kind of mysterious force which acts through man, uses him as an instrument.

The Indians of Dakota, in place of saying "I knit," say, "Knitting by me," as if man were the

hook for the knitting, not the person who works with the hook.

Remnants of ancient speech are preserved also in the languages of Europeans. The French say, "Il fait froid." This means, "It is cold." But, literally, it means, "He makes cold." Again that same "he" who directs the world.

But why dig about in other languages when we can all find in our own languages plenty of remnants of old forms of speech, and that means old ways of thinking.

That unknown, mysterious "it" which is present in such expressions as, "It is raining," "It is clearing up," "It is freezing."

We do not believe in such mysterious forces, but we have preserved in our languages remnants of the languages of ancient people who did believe in them.

We say, for instance, "The watch has been found," as if it were not we who had found the watch, but the watch had been found in some miraculous way.

So, by digging off one layer of speech after another, we find not only the words, but also the thoughts of primitive men. Primitive man lived in a mysterious, incomprehensible world, where it was not he who worked and hunted, but where through him someone or other worked, through him someone or other killed the reindeer—a world where everything happened according to the will of an unseen power.

But time passed. The stronger man became the more clearly he began to understand both the world and his place in it. "I" appeared in language, man appeared, man who acts, struggles, subdues to his will both things and nature.

We no longer say, "It killed the reindeer by means of man," we say "Man killed the reindeer."

Nevertheless there are here and there in our language shades of the past. We still say, "It's unlucky" and "It's fated" or "He's bound."

Who decides the luck, by whom is it fated, by whom is one bound?

Fate, destiny!

This fate, this destiny is the very same "unseen" thing which so frightened primitive man. The word "fate" is still in our language. But we can already foresee the time when it will have disappeared.

The farmer sows his fields with greater sense of security all the time. He knows that it depends on him whether there will be a crop or not. He has machines which turn a barren field into a fertile one, and science which helps him directs the growth of his plants.

With more and more boldness the sailor sets out to sea. He can see the sands deep under the water, he knows beforehand when there is going to be a storm.

"Fated," "born to" are expressions more and more rarely heard.

Ignorance begets fear. Knowledge is power.

So long as people did not know the laws of nature and could not direct its forces, they felt themselves the slaves of nature, the slaves of some unseen power.

But when they learned the laws of nature and of their own life, they began to be masters of their fate and to become free.

CHAPTER III

A GREAT SPRING

The Ice Fields Retreat

Every year when the snow begins to melt, we see everywhere—in the woods, in the fields, along the village street, in the gutters by the sidewalks—boisterous, gurgling little streams, rivulets, waterfalls. They run out from under the slushy, dirty snow like children whom you can't keep indoors in the spring. Jumping over stones, cutting right across the streets, they rush along, filling the air with their cheerful murmur.

The snow, leaving the sunny slopes and open fields, retreats to gullies, ditches, and the shady side of fences where it sometimes succeeds in hiding from the sunlight right up to the first of May.

Wherever you look, all nature is changed. In a few days the sunlight has dressed the bare hillsides with grass, the bare branches with leaves.

That happens every spring when the covering of snow which collected during the winter melts.

What do you suppose happened in those days when that huge ice crust which covered the crown of the earth's sphere with a white cap, began to melt?

Not little rivulets and streamlets, but wide, deep rivers ran out from under the snow. Many of these rivers still flow to the sea, bringing with them on their journey the water of all the brooks, rivulets, and creeks they meet with on their way.

It was a great awakening of nature, a Great Spring, which decked the bare valleys of the North with mighty forests.

But spring doesn't come on all at once. There are days in April when, after a warm, sunny day, a cold wind suddenly comes up. When you wake up next morning, you find everything about you white again, snow on the roofs as if there had never been any spring.

The Great Spring also did not conquer the cold all at once. The ice fields retreated very slowly, as if they were unwilling to go. They held out for centuries.

Sometimes, too, when they had retreated a little, the ice fields stood still for a short time, as if gathering their forces, and then began to advance again. With them came the tundra, or cold, half-frozen plain, bringing along with it its faithful companion, the reindeer.

Moss and lichens spread over the valleys, crowding out the grass. The grazing herds of bison and horses moved southward.

The battle between heat and cold lasted for a long time, but heat won in the end. Roaring rivers

rushed out from under melting ice fields. The snowy cap of the world began to soften and shrink. The farthest edge of the ice fields withdrew toward the North and with it went the southernmost boundary of the tundra. There, where moss and lichens had grown, where only here and there had been scattered clumps of stunted evergreens, thick forests of sturdy pines now appeared.

It kept getting warmer and warmer.

Oftener and oftener the sunny tops of the aspen and the birch climbed up among the dark needles of the pines.

And after them, like a mighty army, big-leaved oaks and lindens marched northward.

The "Pine Age" passed into the "Oak Age." One forest home made way for another. And each of these forest homes had its own tenants.

Along with the leafy forest, along with the bushes and mushrooms and berries, those wild animals who like this kind of forest food came north too. The wild boar came, the elk, the wild ox, and the noble deer with his branching antlers. The brown bear began to break off limbs of trees looking for wild honey. Stepping softly over the fallen leaves, wolves followed the tracks of rabbits. Blunt-nosed, flat-pawed beavers set to work building their dams in the forest streams. Great flocks of birds filled the forests with their songs. Wild geese and swans honked and called above the forest lakes.

In an Ice Prison

While all these changes were going on in nature, man could not stand apart a disinterested onlooker. Everything around him was changing, just as stage settings are changed in the theatre. Only, unlike the theatre, every act here lasted thousands of years, and the stage occupied millions of square miles.

Man was not a spectator at this world show, he was one of the actors in it.

At every change of scene, man had to make himself over, change his way of life in order to survive.

When the tundra crept down to the South it had taken along, as if chained to it, its prisoners, the reindeer. At one end of this unseen chain were the reindeer, at the other end moss and lichens.

The reindeer roamed over those cold, treeless, frozen plains, eating moss and lichens. Man followed along after them.

On the unfrozen plains man hunted horses and bison. In the tundra he had to hunt the reindeer.

For what else was there in the tundra for him to hunt?

The mammoths were all gone. You see man had exterminated them by the thousands, heaping up mountains of mammoth bones round their hunting camps. Horses had also been exterminated to a great extent. Those surviving had gone a

way off to the South where lush grass instead of old dry lichens grew on the plain.

The sole remaining "benefactor" of man in the tundra was the reindeer. Man ate reindeer food, dressed himself in reindeer skin, made spears and harpoons of reindeer horn. Therefore, man had to fit his life to the life of the reindeer.

Where the reindeer went, there man went too. Women hastily threw up huts in their hunting camps, covering them with skins. They knew they were not going to live long in any one place. When the reindeer, followed by swarms of midges, left for other pastures, there was nothing for people to do but to leave their camps too. Taking down the wigwams, the women loaded them onto their backs and struggled through the tundra, stumbling with exhaustion. Beside them, the men travelled light, with harpoons and spears in their hands. It was not man's business to bother about the house.

Now the tundra began to retreat, taking the reindeer along. Thick, impenetrable woods kept spreading farther and farther north, taking the place of the marshy plain.

What happened to people then?

Some hunting tribes migrated, unconsciously, northward to the Arctic, following after the herds of reindeer. This was the simplest thing to do, for man was used to nature as it was in the North. The cold had lasted for thirty-five thousand years. During these thirty-five thousand years, man had learned to take warm skins for themselves from the wild animals. The colder it got outside, the hotter

glowed the fire on his hearth in the dugout, well protected from the wind.

To go to the Arctic was easier than to stay where he was, but the easiest way is not always the best. That part of mankind that went North with the reindeer lost much. For one thing, the Ice Age was prolonged for them. Eskimos in Greenland still live among ice fields and carry on an everlasting struggle with a harsh and miserly nature.

The fate of the tribes who remained where they were was quite different. At first it was hard for them to live in the forests that were rising on every side of them. But, on the other hand, they had escaped from their ice prison where their ancestors had lived for thousands of years.

Man Wars Against the Forest

The forests which grew up in place of the former plain were quite different from our woods of today. They were impenetrable thickets which stretched thousands of miles, right down to the banks of rivers and lakes, in places reaching clear down to the seashore.

It was no easy thing for man to live in this new world to which he was not accustomed. The forest choked him, pressed on him with its furry paws, gave him no place to live, no space. He had to fight with the forest all the time, cut it down, clear it out.

In the tundra or on the plain it was easy for man to find a place for his camp. There was plenty of space all about. But in the woods he had to make a

place. There every bit of ground was taken by trees and bushes.

He had to make war on the forest, take it by storm, as if it were an enemy fortress.

And war without weapons is impossible. In order to fell trees, man needed a new implement. So he tied his heavy, triangular stone sledge onto a long axe handle.

In the thickets of the forest, where formerly only the thumping of the woodpecker was heard, the first sounds of the axe resounded, startling the birds and beasts.

The sharp edged stone cut deep into the wood of the tree. Thick sap dropped from the wounds. The trees crashed, groaning, to the ground at the feet of the woodcutter.

Day after day, persistently and patiently, people cut down the trees, making a place for themselves in the forest world.

When they had made a clearing, they burned out the stumps and underbrush.

So man fought with the forest and conquered it. But he gave no peace to the conquered and beaten foe. Cutting off branches, men sharpened one end of the tree trunk, and drove it into the ground with blows of a wooden mallet. Alongside this first pole they put a second, a third, a fourth. They made a fence and interwove it with branches. There, among the trees, arose the first wattled hut, looking very like the forest itself. There were tree trunks, just as in the forest, interwoven with branches. But these tree trunks did not stand hap-

The hunter had to exchange his dart for the swift and sure arrow

hazard, they were arranged in a fixed order, the order in which man had placed them.

It was hard for man to get a place for himself in the forest world. It was even harder to get something to eat.

On the plains and prairies he had hunted animals which travelled in droves. It was easy to see them from a distance. From the summit of any little mound the ground lay spread out before him like a panorama.

It was quite different in the forest. The forest house was full of tenants, but they were not in sight. They filled every floor of the forest with their voices, their rustling, their calls, their noises, but it was hard to follow them and find them.

There at your feet was a rustle, something flew overhead, something brushed against the leaves in the branches of a tree....

How were the hunters to get their bearings among these rustles and scents, these varied spots among the spotted tree trunks?

Every forest animal, every bird had its own protective colouring. The feathers of the birds were like the bark of the trees. The brown fur coats of the animals in the semi-darkness of the forest blended in with the brown of fallen leaves.

It was hard to track an animal, and when you did get on his track, you had to get him the first shot, before he hid or disappeared in a thicket. So the hunter had to exchange his dart for the swift and sure arrow.

With bow in hand and a quiver full of arrows on his back, the hunter penetrated into the thickets, chasing the wild boars and shooting the noisy wild geese and ducks.

A Four-legged Friend

Every hunter has a great friend. This friend has four paws, big soft ears, and a black, curious nose.

This four-legged friend helps his master find his prey when he is hunting. At dinner he sits beside him, looking up into his eyes, and seems to ask, "Where is my share?"

This faithful four-legged friend has been serving the hunter not for merely one year, but for thousands of years. For man tamed the dog way back in those times when he killed his prey with a light, feathered arrow, instead of with buckshot fired from a gun.

In the forest peat bogs, alongside remnants of the hunting camps of men are found remains of camps for dogs too. And in the kitchen-middens or refuse heaps which are found in the forest near where a settlement has stood, bones of wild animals with marks on them made by dog's teeth are still preserved. Evidently in those days, too, dogs sat beside the hunter at dinner and begged him for bones.

But it is hardly likely that man would keep a dog and feed him if he wasn't useful to him. When man domesticated the dog, the hunter got a helper for himself; he taught him to follow the tracks of wild animals.

And man made no mistake in his choice. Before he himself could see the tracks of a wild boar or hear the footsteps of a deer, the dog was already on guard and began to pick up the scent along the ground.

What is that smell in the leaves? What went along here? Two or three whiffs of the air and the track is found. Without seeing or hearing anything in the neighbourhood, guided wholly by his most important sense, smell, the dog runs confidently through the forest. All man has to do is to follow him.

When man tamed the dog, he became stronger than he had been before. He used the dog's nose, which could distinguish scents better than his own.

He took into his service not only the dog's nose, but also the dog's legs. Long before the horse was harnessed, dogs drew man on a sledge.

In Siberia, not far from Krasnoyarsk, bones of dogs along with bits of their harness have been found near the site of a primitive hunting camp.

That is, the dog not only helped man hunt, he also carried the hunter along with him.

So in the biography of man, we meet his friend, the dog, for the first time.

How many stories about dogs have been written—about dogs who saved the lives of travellers in the mountains, about dogs who have carried their wounded masters out of the battlefield, about dogs who have kept guard not only over the threshold of a home but over the borders of a country!

The dog serves man faithfully both at home, in the hunt, in battle, and in the scientific laboratory.

Man Wars with the River

Not everyone went to the tangled forests. There were some who left the thickets and went to the shores of rivers and lakes.

There on the narrow strip of land between the water and the forest, people built their wattled huts.

On the river bank there was more open space than in the forests, but living there was not easy. The river was a restless neighbour. In the spring it overflowed and flooded its banks. Along with ice floes and logs that had fallen into the water, it often carried down the huts made by man. The inhabitants, seeking safety from the flood, took to trees and sat there waiting to see how soon the river would change its wild mood for a milder one. And when the river returned to its bed they set about rebuilding their ruined home on the bank again.

At first every flood took them by surprise. But as they watched the river, noticed its rising and falling, they were able to outwit it.

They cut down several trees and tied them together and laid them along the bank. On the first row of logs they piled another. Little by little a high, wide platform was formed by the logs. And there, on the platform, they built their huts. Now the flood had no terrors for them. When the water came raging over the banks it could not splash even the foundations of their houses.

This was a great victory for man. It's no joke to turn a low bank into a high one! From this platform, built of logs, have come all the dams and dikes we use for keeping rivers in check.

Man worked hard and long in this war with the river. And why was it he wanted to settle right on the river, what lured him to the water?

Ask this question of a fisherman who spends whole days on the river patiently watching his cork float. The river lured him because there were fish in the river.

How did it happen that hunting man became also a fisherman? He had to have an entirely different equipment for fishing, and different ways and methods.

When we find a break in the chain of events we must try to find the missing link.

A hunter could not become a fisherman overnight. That is, before he could begin to catch fish, he first had to hunt them. And that's just what man did. The first fishing tackle was a gig, very little different from a spear. The fisherman would wade about in the water up to his waist, and when he found fish hiding among the rocks, he would kill them with his spear. Then he began to get them in another way. He had already learned to catch birds with a net, so he tried to use his net in the water too.

So, little by little, man provided himself with fishing tackle. Along with harpoons and spears, archaeologists find stone weights for nets and bone fish hooks buried in the ground.

The Grandfather of Our Ships

Sixty years ago, not far from Lake Ladoga in Africa, some workers were digging a canal. As they dug up the peat and sand, they came on a human skull and some stone implements.

This came to the attention of the archaeologists. And from this swamp where they had thought there was nothing but peat, the archaeologists got all kinds of things, just as if they were taking them out of a museum cabinet: a stone axe, a stone knife, a fish hook, an arrow head, a harpoon with a saw-toothed edge, and a little whale carved out of a piece of bone, a talisman.

After these stone and bone implements, they dragged out a whole canoe to their great delight. This canoe was so well preserved that you could get right in it today and start off paddling on the water.

It is not very like our boats of today. This grandfather of our boats, steamers, and Diesel-power boats was chopped out of a big oak log. As you look at it, you seem to see with your own eyes how the stone axe bit into the heart of the oak. There where the chopping went with the grain it was not so bad, but when it went against the grain, it was not merely work, it was punishment. The wood is cut and hacked in every direction, as if the stone teeth had gnawed fiercely at it. In places where there were knots and branches, the axe simply wouldn't work. Men had to give up and call in fire to help in their fight with the tree.

The whole stern is scorched, covered with a black crust of charcoal. Evidently it wasn't much easier to make a canoe in those days than it is to make a whole ship today.

They found the very axe the canoe had been made with, in the peat alongside the canoe. The edge of the axe was polished and sharpened. Not far away there was also a whetstone. That is, by that time they already knew not only how to chip with a stone sledge, but also how to polish and sharpen.

It would be hard to imagine a dull axe doing all that cutting on a tough oak tree. It was a long, tough job to turn an oak log into a boat.

When the work was at last finished and the canoe launched, men took their harpoons, hooks, gigs, and nets, and set out on a fishing expedition.

It was a big lake and there were lots of fish in it, but they didn't go far from the shore.

Water was a new, untried element to them. How were they to know its ways, guess its capricious changes? One moment it would be calm, quiet, and gentle, the next it would begin to rage, roar, toss up big waves.

The big oak log which even a storm could not sink, bounded over the waves, whirling round and round like a light plank. They pulled for the shore in terror. At last they set feet on the firm ground, ground that did not shake and hump itself up and make big waves. As a child clings to his mother, man clung to the mother who bore him, the earth.

Instead of venturing far out into this treacherous watery space, stretching way off to the very end of the sky, man waited for the fish to come to the bank.

Warily, step by step, man began to conquer the watery wastes.

There was a time when the world was bounded for him by the limits of the land. Every bank was, as it were, walled off with a sign of "No Admittance" on the wall.

Yet man managed to get through this unseen wall. He still kept to the edges of this, for him, new world—the world of water. But, at any rate, the hardest was over—the beginning. The time was coming when man would wrench himself loose from the shores. Not in a light canoe, but in a ship he would sail out on the open sea, to discover, far beyond his own boundaries, new lands, settled by people like himself.

The First Artisans

You young artisans who have just taken axe, plane, hammer, and screwdriver into your hands for the first time, you future chemists and metallurgists, makers of lathes, of airplanes, builders of houses and of ships, this book is written for you who love your tools and your work.

You know the difficulties, and the struggle of tool against materials, and the joy of mastering these difficulties.

When you pick up a piece of wood you already have a picture in your mind of the thing you are go-

ing to make. It seems simple enough. All you have to do is to saw here, bore there, and then cut out. But the material isn't docile. With all its might it opposes the knife blade stuck into it.

You try one tool after another. When the knife fails, you use an axe. When the axe is unequal to the job, the dozens of tiny, sharp knives on the blade of the saw gnaw into the wood.

Soon all the excess material that hid the shape you wanted is out of the way, turned into chips, shavings, and sawdust.

The victory is yours, but it is not yours alone. It is the victory also of all the workers who, throughout so many ages, have been inventing and perfecting tools, seeking out new materials, new methods of work.

Here in this book you have met these first craftsmen, those who created the knife, the axe, and the hammer. You have seen them at their work which, like yours, was hard and at the same time fun.

Those first carpenters, first ditch diggers, first masons were dressed in the skins of wild animals. It took them several months to make a little boat. It was harder for them to model a clay pot than it is for us to model a statue. But from these carpenters, ditch diggers, potters have come all the builders, chemists, metallurgists who by their work are changing the world today.

Take the primitive potter, for instance, the first one to create out of clay a material which did not previously exist in a natural state. This was a

double victory, a victory over the clay and a victory over fire. True, people had used fire before this—it kept them warm, scared off wild animals, helped them clear out the forests, and came to the aid of the axe when man was building his canoe. People had by this time learned how to make fire; it came obediently when they rubbed two pieces of wood together.

But now man gave fire a new, more complicated task, to turn one substance into another.

Man had observed the effects of fire and he set it to firing clay, boiling food, baking bread, smelting ore.

Today it would be hard to find any factory where fire is not working, turning one substance into another.

Fire helps us get iron from ore, glass from sand, paper from wood. An army of chemists and metallurgists direct the fires which burn in factory furnaces. And all these furnaces are the descendants of that fire on an open hearth where early potters fired their first clumsy, conical-shaped pots.

A Grain of Cereal Tells a Story

In one of the hunting camps archaeologists found, among other things, several clay crocks.

The crocks were decorated with a simple pattern of crisscross lines. This pattern gives the clue to how they modelled and fired their pots.

They lined a woven basket with moist clay, then burned it in the fire. The wicker basket burned off: the pot remained. This left a clearly outlined

crisscross pattern of the witches of the basket on the outside of the crock.

Later, when they began to model the pots without the help of the basket, the potters scratched this crisscross pattern on them. They thought the pot wouldn't cook right unless it was like those in which their grandmothers and great-grandmothers before them had cooked.

Craftsmen in those days thought that everything possessed hidden, mysterious powers within itself, and, as likely as not, the crock's power lay in the pattern on it. Change the pattern and you'll be sorry. The pot may bring you bad luck, want, hunger.

Sometimes the potter drew a dog on the crock to ward off the "evil eye." A dog was a guardian —let him guard both the pot and its contents.

Clay crocks with crisscross patterns have been found in many places. One of them, discovered near the city of Compiègne, France, is especially famous. When the archaeologists examined the pattern on it they noticed the imprint of a grain of oats.

They were excited by their discovery, for this was not simply a grain of oats, it was a witness, a tiny witness which told of very important changes in the life of man.

Where there was grain, there must be agriculture. And, sure enough, in the very same settlement where they found the pot with the grain of oats on it, they found also grain graters and stone hoes for digging up the ground for planting.

Evidently our hunters and fishermen had begun to be farmers, too.

We must remember that not every member of the tribe was engaged in hunting and fishing. While the men were out hunting, the women and children were scouting about the camp site, some with baskets, some with jars, gathering everything edible they could find. They got shellfish along the seashore. In the woods they gathered mushrooms and berries and nuts. They didn't scorn acorns, either, but ground them into flour and baked loaves of bread of it. That's why in some languages "cereal" is still called "acorns."

They were especially delighted when they discovered a hive of wild bees. There's a drawing on a cliff representing a woman getting honey. She has climbed up into a tree and is emptying out the hive with one hand, holding her jar in the other. Swarms of bees are buzzing angrily all about her, but she is paying no attention to them but going right on getting out combs full of honey from the hive.

The women and children came back from every expedition with a load of honey, berries, wild apples and pears.

What a grand feast! But the housekeepers were very careful of their supplies. They drove the children off and stored away everything they could in pots, jars, tubs. These stores might come in handy any day, for hunting was a precarious business.

So when the climate became mild again, people once more became gatherers. You might think

this was a step backward, but, as a matter of fact, it was a great leap forward. From gathering people went on to sowing, crossed the line which separates the gatherer from the grower.

Along with fruits and berries the women brought in grains of cereals, too—wild oats, wild wheat. As they were putting these seeds away in crocks and jars, they spilled some grain on the ground. Some of it sprouted. It sowed itself.

At first people sowed accidentally, simply lost some of their seeds. Later they began to scatter them on purpose, to sow the seed.

Among many peoples there are myths, legends, about the burial and resurrection of grain.

Some of these legends tell about a young maiden and a youth who while still alive went down into the kingdom of the dead and afterwards returned miraculously to the earth.

When, in those ancient times, the women hoed the ground and afterwards planted the grain in it, they believed they were burying a mystic divinity which would return to them with golden curls. And in the autumn when they gathered the ears of grain, they celebrated the return of the divinity from the underworld.

They stood the last ear up on the ground, danced and sang around it. This was not merely a dance; it was a magic ceremony. The women were singing the praises of the grain and entreating the earth to be always gracious to them.

The Old in the New

At the beginning of this century, there were places where after the harvest the people had a Harvest Festival.

They took the last of the grain and put a kerchief and skirt on it, then joined hands and danced around it, singing at the tops of their voices so you could hear them in the next village:

On our farm, on our farm
Today is Harvest Day.
Glory to God!
One field is harvested,
Another one is ploughed.
Glory to God!

The weird, plaintive sounds of this chant were very different from the gay folk songs heard in the villages at nightfall, when the girls and boys made the rounds of the village.

This Harvest Festival was really an ancient ceremonial, handed down from the time of the first agriculturalists.

Many such ceremonials have come down to us in children's games and songs. Children join hands and sing:

Oats, peas, beans and barley grow,
Oats, peas, beans and barley grow—

This singing game was also once a ceremony. As it has come down through the centuries it has

lost all its old, magic meaning and only its tone of rejoicing is left.

And the Christmas tree! The Christmas tree was once a sacred tree. People danced around fir trees to bring back life to the sleeping forests and fields, to bring spring back after winter.

Our children, who so love to trim the Christmas tree, do not think of it as a holy tree. To them it is just part of the gay holiday festival.

Many ancient ceremonies, incantations, exorcisms are passing their old age among children, like old people who love to have children about them.

Rain, rain, go away!
Come again another day!

Children haven't the least idea, when they sing this, that they will either chase away the clouds or bring back the rain. They sing it just because they like to sing.

Grown up people, too, aren't always above playing games and singing songs which had quite another meaning in olden days.

In Italy and in France they still celebrate the burial of Carnival. The people turn out into the streets in a great procession. The gravediggers carry an effigy of Carnival, dressed in motley rags. They march along in silence, each one with a trumpet in his hand and a bottle in his pocket. From time to time the procession stops and the gravediggers refresh themselves with a few swallows of wine.

A woman, representing the wife of Carnival, heads the procession. She pretends to be crying and makes a great show of grief. This brings shouts of laughter from the crowd.

The procession goes to a public plaza where a bonfire is burning and the gravediggers throw Carnival into the fire. The effigy burns to the accompaniment of the rattle of drums; then a gay festival begins.

The streets are full of masked merrymakers. Every park has a band and gay couples whirl about dancing.

Who is this Carnival whose funeral is made so much of?

If you should question the jolly gravediggers about this, or the "widow" of Carnival, they would say, "It's just an old custom." But they could not tell you where the custom came from. People have entirely forgotten the meaning of the ceremony in the thousands of years since it originated.

Its original meaning was this: Carnival symbolizes death, which covers the earth with a white shroud in winter. Who knows whether or not he has taken possession of the world forever? Primitive man had no assurance that spring would return after winter. For he did not yet know anything about natural laws. Every spring seemed a miracle to him, a miraculous resurrection of nature. And man did everything he could to bring about this miracle by means of magic-working ceremonies.

To bury winter, to resurrect spring, to bring flowers back to the fields and leaves to the trees—

that was the purpose of these games and dances, that was why they cremated winter.

And these old ceremonials and superstitions have come down to us as gay festivals.

They are with us in other ways, too.

At solemn Easter services in churches, we hear in the prayers echoes of the ancient magic songs. These prayers, like the songs of primitive agriculturalists, speak of death and resurrection. What has survived outside the church in games still survives in the church as a religious ceremony.

A Magic Storehouse

While the women were hoeing the ground and planting grain, the men were spending whole days hunting, returning home in the evening loaded down with game.

When the children saw their fathers and big brothers coming home, they ran to meet them, eager to be the first to find out whether they had had any luck. They gazed wide-eyed at the bloody snout of the wild boar with its long curved tusks sticking out at the sides of its mouth, and at the branching horns of the deer. But what delighted them most was when the hunters brought or led with them some live animals—little frightened lambs or a helpless calf which had not yet sprouted its horns.

The hunters didn't kill their four-footed prisoners at once. They kept them penned and fed them so they would grow. They felt safer when they could hear lambs bleating or calves bawling about the place. They knew then that they would-

n't run out of meat, even if the hunting were poor. They now had a supply safely penned in, and, better still, a supply that kept getting bigger all the time.

At first people kept cattle only for their meat and skins. They didn't realize immediately the advantages of cattle raising. Hunters regarded cattle as game and they were in the habit of killing game. It wasn't easy for them to get the idea that it paid better to let a cow or a sheep live than to kill it.

You can eat a cow only once, but you can drink her milk for many years on end. Yes, and you can even get more meat from her in the end, if you don't kill her, for every cow can have a calf every year.

The same thing is true with a sheep. It's an easy thing to kill and skin it, but you can't do so very much with one skin. It pays much better to let the sheep keep its skin and only cut off the wool. New wool grows after every shearing and you can get dozens of skins for yourself from a single sheep, instead of only one.

Instead of killing their four-footed prisoners it paid them much better to spare their lives and get a tribute from them in return.

But people didn't realize this immediately, and many ages passed before the warlike hunter became a peaceful shepherd.

What did all this really mean?

They hid the grain they gathered in the ground and the earth gave them back many grains for every one. They left their game alive and in return it increased in numbers and grew in size.

Man became freer, felt himself less dependent on nature. Formerly he never knew whether he would track down and kill a wild animal, or whether he could find enough grain to fill his baskets. The mysterious powers of nature might send him food, or they might withhold it. Now man had learned to help nature; had learned to grow grain, and hunters didn't have to hunt and track down wild animals in the forest.

Grain grew in patches around their homes and cows and sheep fed in pastures near by.

Man had discovered a magic store-house, or rather he had created one by his work.

Now he had to have land for his fields and pastures. He had to win this land from the forest, and he had to dig up and make furrows in the ground. What a lot of work this meant!

Man didn't just saunter into his freedom, his independence from nature. He got it by hard work, by overcoming thousands of obstacles. The new work had both its joys and its sorrows. The sun might burn up his crop, burn up the grass in his pastures and meadows. Rain might wash out the seed he had planted.

The primitive hunter begged the bison or the bear to give him its meat. The primitive farmer begged the earth, the sky, the water to give him his crop. People created new divinities. These new divinities were still like the former ones. According to their old custom they imagined them as looking like animals or like people with heads of animals. But these divinities had new names and new occu-

pations. They called one Sky, another Sun, another Earth. It was their business to send light and darkness, rain and drought.

Our man-giant has grown, become stronger, but still does not know his own strength. Just as of old, he believes that it is heaven that gives him his daily bread and not his own labour.

CHAPTER IV

THREE THOUSAND YEARS LATER

The Hour Hand Is Moved Ahead

Let's move the hour hand of history three thousand years ahead. That will be only some forty centuries before 1941.

Forty centuries! That is a long time when you're talking about the life of a single individual or even of an entire nation. But, you see, we are not talking about a single individual but about Man with a capital M, about mankind.

Man with a capital M is at least a million years old. For him, forty centuries is not so very long a time.

So—the hour hand is moved. The earth's sphere has completed several thousand circuits around the sun. What has happened to it in the meantime?

At the first glance we notice that it is getting bald in spots. In the old days only snow caps stood out among the black masses of thick forests! But now the forests are thinned out. Broad tongues of bare land have licked into them. Here and there

The settlement is surrounded by a high stockade

the thickets are separated by broad sunny fields. The banks of rivers and shores of lakes extend farther and farther back from the water's edge, leaving wide strips covered with reeds and bushes.

And what is that on a hill beside the bend of a river there? It looks as if a yellow kerchief has been spread over the hillside.

It is a bit of land that has been changed by the hands of man. The bent backs of women are seen among the heads of grain. Sickles swish rapidly cutting off the ears.

We made the acquaintance of the hammer a long time ago. This is the first time we have met the sickle. It's quite different from a present-day sickle. It is made of stone and wood, stone teeth set into a wooden holder.

This is a field—one of the first fields in the world. There are only a few such yellow kerchiefs in the midst of wild nature as yet untouched by man. There are many patches of weeds among the grain in this early field. People haven't yet learned how to get rid of weeds. But the ears of grain have the best of it and the time is coming when a golden ocean will flood the earth.

In the distance, in a green meadow near the river, some tiny figures are visible: white, yellow, spotted. The little figures move about, now far apart, now huddled together. Some are larger, some smaller. This is a herd of cows, goats, and sheep. There are not many of them—of these animals which have been changed by the work of man. But they multiply more rapidly than their wild

relatives who have to look after themselves. In a few thousand years there will be many more cows and bullocks in the world than there are wild buffalo on the plains.

Fields and herds....that means there must be a settlement somewhere in the neighbourhood. And there it is—on a steep bank rising up out of the river. You see at once that this is something entirely different from the old hunting camps. In place of huts made of poles and interwoven branches, here we have real wooden houses with two-sloped roofs. The walls are plastered with clay. Over the door a beam sticks out from under the roof and on it is carved the horned heads of a bullock. The bullock is a divinity protecting the house. The settlement is surrounded by a high stockade and a girt embankment.

It smells of smoke, manure, fresh milk—the familiar smells of an old village of our childhood! Children are playing around the houses, hogs with their litters of little pigs are wallowing in the mud. A fire is seen through the open door of a house. An old woman is baking bread on the hearth. She puts the loaves in the hot ashes and covers them with a clay crock. A crock instead of our oven! On a shelf near by are decorated wooden bowls and mugs.

Let's leave the village and go down to the river. At the edge of the water a canoe, half filled with water, is bobbing up and down. If we should go up the river to the lake from which it flows, we would find another village, but of quite another kind.

This village is not on the shore of the lake, but right out in the water, like an island.

Piles are driven into the bottom of the lake, beams laid across the piles, planks laid on the beams. A little bridge leads from the shore to the village. On the walls of the houses fish nets are hung out to dry.

Evidently there are lots of fish in the lake, but the inhabitants of the village don't live on fish alone. Among the houses are round, peaked barns made of interwoven branches, where they store their grain. From a cow shed alongside the barn, we hear the lowing of a cow.

This ancient village we have been picturing to ourselves disappeared long ago. Water has covered the place where the houses stood. How are we going to find relics of these dwellings on the bottom of the lake? It seems impossible, but at times the lake recedes and uncovers to our gaze what it has preserved for centuries.

The Lake's Tale

There was a big drought in Switzerland in the year 1853. The water of the lakes receded from their shores, leaving the muddy bottom exposed.

The citizens of the town of Obermeilen on the shores of Lake Zurich decided to take advantage of the drought and get back some dry ground from the lake.

To do this they had to dam off that part of the lake which had been left bare. Work began and they got the dirt out of the lake bottom which

had been left dry. Teamsters hauling dirt were heard shouting to their horses where formerly on Sundays gaily dressed crowds of towns-people had rowed about in blue and red boats.

One day the spade of one of the diggers struck against a half rotted pile in the ground. Beyond the first pile they found a second, a third.... Evidently people had worked once before on this very same spot. With almost every shovelful of dirt they brought up stone axes, fish hooks, bits of broken pottery. Archaeologists set to work. They studied every pile, every article found on the bottom of the lake, and created for us on the pages of a book, the village built on piles which had once stood in Lake Zurich.

Now several such villages have been discovered. Recently archaeologists were carrying on their explorations in another Swiss lake, Neuchâtel. They made several cuts in the lake bottom and found that it was composed of a series of layers. Just as in a layer cake it is easy to distinguish the dough from the filling, so here each layer was easily distinguishable from the other. At the bottom was a layer of sand; then a layer of silt, with remnants of dwellings in it, and of utensils and tools belonging to the people who once lived in the dwellings; then sand again. This was repeated several times. Only in one place, between the two layers of sand, there was a thick layer of charcoal.

What made these layers?

Water could have brought the sand, but where did the charcoal come from?

Fire had evidently been at work here.

From a study of the layers, the scientists learned the whole history of the lake. Once long, long ago people came to this lake and built their settlement on its shores. Later the lake rose and overflowed the shores.

The people left, abandoned their drowned-out village. The buildings rotted and fell to pieces in the water. Shoals of little fish swam around above the roofs where swallows used to twitter. The sharp toothed pike swam through wide open doorways, lazily flapping his fins. Crabs poked their feelers around under the shelf near the stove.

But the lake did not stand still. Little by little the water began to recede from the shores and leave the bottom bare. The strip of sand on which the village had formerly stood was dry land again. But there were no signs of the village left. Its ruins were buried deep under a layer of sand.

People came to the lake again. The air was full of the sound of axes. Curling white shavings were strewed about over the yellow sand. Stout new houses rose one after another on the shores of the lake.

So the struggle between man and the lake went on, with varying fortunes—the people building, the lake destroying.

Finally the people got tired of the struggle. They stopped building on the shore and began to build their houses out in the water on tall piles driven into the bottom of the lake. Through the cracks in their floors they could see the deep water

beneath them, but it had no terror for them now. Let it rise as high as it wanted; it wouldn't reach their floors.

But people had another enemy besides water —fire.

In the old days when they lived in caves, fire had no terror for them. The stone walls of a cave don't burn down. But along with the first wooden houses came the first conflagrations.

The fiery red beast, which for so many thousands of years had meekly submitted to man, suddenly showed its claws.

The thick layer of charcoal found on the bottom of Lake Neuchâtel is the mark left by an ancient conflagration.

Then there was panic on the lake. People threw themselves into the water, clasping their children in their arms. The helpless animals lowed and bellowed in their pens, but people had no time to think of them. The wooden village burned like a huge bonfire, sending sparks in every direction.

The fire was a terrible disaster for the people who lived in the village. But the very fire that burned their homes preserved invaluable objects for us, for our museums: wooden utensils, fish nets, and even seeds of plants.

By what miracle did fire, the destroyer, preserve for us things it could so easily have burned?

This is the explanation: the things caught fire and fell into the water; the water put the fire out and saved them; and the things dropped to the bot-

tom of the lake unharmed. Then another danger threatened them; they might rot. But they were again saved by the fact that, as they had been in fire, they were covered with a coating of charcoal which kept them from rotting.

Either fire or water alone would have destroyed them, but working together, they saved for us such a perishable article as a bit of linen cloth, woven thousands of years ago.

The First Textile

The first weaving was not done on a power loom. It was braided by hand.

Eskimos still braid instead of weave. They stretch the long threads, the woof on a frame. They pull the short ones, the warp, through them with their fingers, without any shuttle—under, over, back and forth.

It's hard to recognize our power looms in this frame with the threads stretched across it; yet the power loom traces its origin straight back to just such simple frames made of four cross pieces.

The scorched, blackened rag found at the bottom of the lake tells us of a very important event in the life of man. Man, who had formerly dressed in the skins of animals, finally got to work making pieces of material instead of merely sewing up skins.

How much toil and trouble the blue-flowered flax fields added to women's work! Before their hands had time to rest from holding the sickle, they had to tear up the flax, pull it out of the ground, roots and all; dry it, wash it, and dry it again. They

weren't through yet. They had to pound the dried flax to pulp, and comb it out. And, finally, they had to whirl the spindle and turn these fibres into thread. Only after all this could they begin to weave.

Women took an infinite lot of trouble to make cloth, but in return they got gay kerchiefs, aprons, and petticoats with bright coloured fringe and gay trimmings.

The First Miners and Metallurgists

In every house today you can find any number of things made of artificial materials, materials not found in a natural state.

There is no natural brick or porcelain or cast iron or paper. To get cast iron or porcelain, man takes materials found in nature and changes them so that they are unrecognizable. Cast iron doesn't look in the least like iron ore. Who would ever recognize in a thin, translucent porcelain cup the original clay of which it is made?

And such materials as concrete, cellophane, plastic, artificial silk, artificial rubber! Did you ever see a mountain cliff of concrete? And where is the silk worm that can make silk out of wood?

In mastering matter man penetrated deeper and deeper into nature's workshop. He began by polishing one stone with another. Now he works with molecules, tiny particles you can see only under a microscope.

This work began a very long time ago, long before chemistry, the science of matter, appeared.

Gropingly, hardly knowing himself what he was doing, man learned to change matter.

When the first potters fired clay, they were mastering matter, although they didn't realize it themselves. It was no easy thing to do. You don't make over the minute particles of which matter is composed by moulding, you don't change its form with your hands as you change the shape of a stone. It is not hand power that is required, but another force which can reconstruct matter.

And man discovered this force when he took fire to help him. Fire glazed his clay; fire changed his flour into bread; fire smelted copper.

How did it happen that man, who had made his tools of stone for so many thousands of years, suddenly began to make them of metal? And where did he find the metal?

When we go walking about in the woods or fields we don't see any pieces of pure copper lying about. A nugget of copper is a great rarity today, but it was not always so. A few thousand years ago copper was much more common than it is now. There was plenty lying about but people paid no attention to it for they made their implements of flint.

They began to notice the copper nuggets only when flint became scarce because people were careless about using it. When they were working, there would be big piles of waste scraps and chips lying about which they couldn't use. Just as today, a carpenter may be judged by the kind of scraps lying about his workshop.

After thousands of years the supply of flint was noticeably diminished. If today we took a notion to make our tools of flint, we could not find sufficient supply, because our ancestors didn't leave enough for us.

There began to be a shortage of flint in the world and this was a major disaster. Imagine what would happen in our factories and mills if there were a shortage of iron! We'd have to go down deeper and deeper into the earth to get our ore.

That's what people did in ancient times, too. They began to dig mines—the first mines in the world. Ancient mines of thirty to sixty feet depth are found in several places in strata of chalk. Chalk and flint often go together.

It was a perilous thing for people to work underground in those days. They had to go down either on a rope or on a notched pole, and it was dark and smoky below. They worked by the light of a pitch torch or a little oil lamp. Today mine shafts are braced with wooden beams to strengthen them, but in those times man didn't know anything about bracing the walls and arched vaults of the underground passages. Very often it happened that the earth caved in and buried people. Skeletons of miners are found in some ancient flint mines under heaps of chalk, with their tools beside them—picks made of deer horn.

In one place they found two skeletons, one of a grown man, the other of a child. Evidently a father had taken his son down to work within him but had not taken him home again.

Every century flint got scarcer; it became harder and harder to find. But man had to have flint. He made his axes and knives and hoes of flint.

Something had to be found to take its place.

Copper came to the rescue. People began to examine it; what kind of green stone was this, and was it good for anything?

They took a piece of copper and tried to break it with a hammer, for, you see, they thought it was a stone and tried to work on it just as they worked on stone. The more they hammered the harder the copper got, and it changed its shape, too. They hammered harder than ever. When the blows got too heavy, the copper crystallized and flew to pieces.

That's how man first began to forge, to work metal. True, it was cold forging, but it wasn't a very great step from cold to hot working.

A copper nugget, or perhaps a piece of copper ore, happened to fall into the fire. Or maybe man tried firing copper on purpose, just as he fired clay. When the fire died down, a little, flat cake of smelted copper was left on the hearth stones.

People looked in amazement at this "marvel" they had created with their own hands. They thought it was the spirit of the fire, not they themselves, that had changed a greenish-blue stone into shining red copper.

They broke the cake of copper into pieces, hammered these pieces with their stone axes into picks and knives.

So in the magic store-house man found a shining resonant metal. He threw ore into the fire, and it came back to him copper.

And this marvel was the work of man.

A Labour Calendar

We are in the habit of measuring time by years, centuries, thousands of years. But one who is studying the life of ancient man must use another kind of calendar, another measure of time. In place of saying, "so and so many thousand of years ago," we say, "in the Old Stone Age," "in the New Stone Age," "in the Copper Age," "in the Bronze Age." This is not a yearly calendar; it is a labour calendar. By means of this calendar you can see at once what stage man had reached in his journey.

In the ordinary "yearly" calendar there are both large and small measures of time: century, year, month, day, hour.

In the labour calendar there are also large and small measures. You may say, for example, the "Stone Age" in the period of the sledge, or the "Stone Age" in the period of polishing.

The yearly calendar and the labour calendar do not always coincide. There are places in the world where people still work with stone implements. In Polynesia there are still villages built on piles in the water.

This is because people did not all advance at the same rate in their work. Australia, which was cut off from the rest of the world, was left behind,

because it was away from the main stream of human experience.

It was not so with the Europeans. When copper axes or clay jugs appeared anywhere on the continent, they gradually spread from one tribe to another.

People paddled along the rivers in canoes from one village to another to exchange copper for amber, skins for flax. One tribe might be rich in flint, another in fish, a third famous for its pottery. And so the pile-dwellers on the lake would have visitors who came to exchange wares with them. Along with their wares they exchanged experiences, and new methods of work, too.

The people often had to return to the language of gestures, because the different tribes spoke different languages. But, even so, when they left, these visitors would take along not only foreign articles but also some new words they had unconsciously picked up.

So the languages of the various tribes were mingled and intercrossed. And along with the words, their ideas were also mingled and intercrossed, for ideas are inseparable from words. Foreign deities took their places alongside the native ones. Out of many forms of belief, there grew up one form which, in the future, would embrace whole nations.

The gods travelled about. In new places they were often called by new names, but they are easily recognized.

In studying the religions of ancient peoples, we recognize one and the same god in the Baby-

lonian Tamuz, the Egyptian Osiris, and the Greek Adonis. It is always the old god of the agriculturalists who dies and is resurrected.

Sometimes we can point out on the map how the gods travelled. Adonis, for example, came to Greece from Syria, the country of the Semites. The very name "Adonis" proves this. In the Semitic language it means "mister," and the Greeks, not knowing the meaning of the word, used it as a proper name.

So the exchange of things, of words, and of beliefs went on.

It cannot be said that the exchange always went on peacefully, without clashes. If the "visitors" could take their copper or cloth or grain by force, they did not hesitate to do so. Trade, which even without this was trickery, became open brigandage. Visitors and hosts seized their weapons and decided the issue by a pitched battle.

No wonder the villages began to look like fortresses. The villagers began to surround them with stockades and ramparts so guests would not come uninvited.

People were very suspicious of members of a strange tribe. It was not considered a sin to rob or kill a stranger. Every tribe called its own members people, but didn't consider members of other tribes as people like themselves. They called themselves "children of the Sun," "Children of Heaven," but called strangers insulting nicknames which often stuck to them and later became the name of the tribe.

There is a tribe of Indians called "Dusty Noses" and another one called "Crooked Folk." It's hardly likely these tribes thought up such uncomplimentary names for themselves.

Remnants, relics of this ancient enmity for strange peoples are still found today—and this is a terrible thing. In the Iron Age, or rather in the Age of Aluminum and Electricity, there are still people who preach enmity toward strangers, race hatred. They consider only themselves as people; others, according to them, are not human beings but creatures of a lower order.

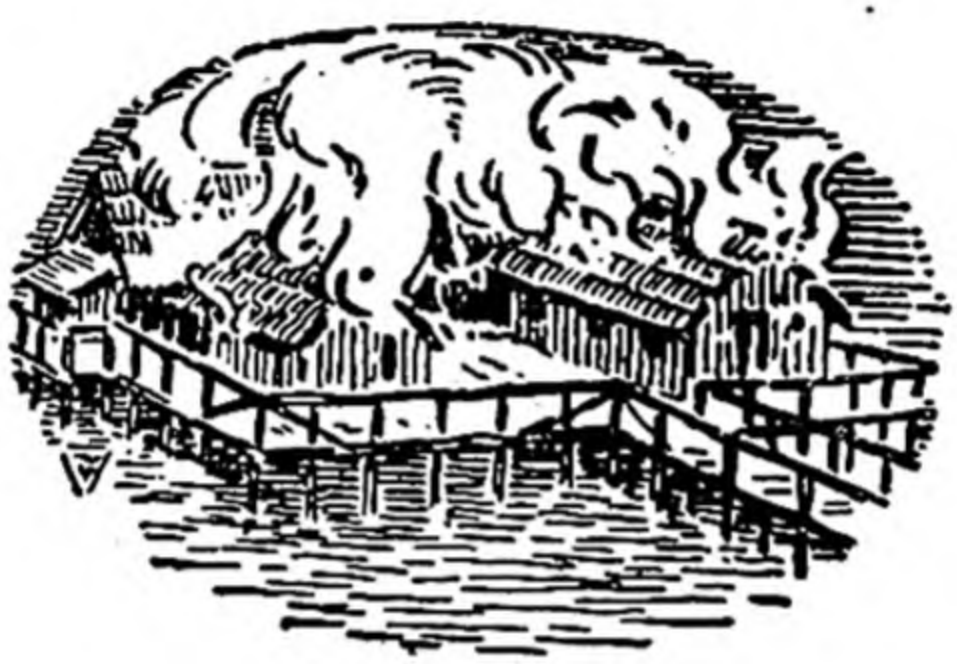
Enmity toward a stranger, an "alien," toward a person of another tribe is a relic of old, outlived, primitive feelings and superstitions.

History teaches us that there are no higher and lower peoples. There are advanced people and people who have lagged behind on the road of culture. According to the labour calendar, people living in the same period are far from being all contemporaries—belonging to the same era.

Not all nationalities are equally advanced. Some are in the age of machines, others are ploughing with the old, primitive wooden plough and weaving their clothes on primitive hand looms. There are some that make their weapons of bone and do not know that there is such a thing as iron.

The advanced peoples should help the backward ones. During the last two decades the people of Central Asia, Siberia, and the Far North have advanced a century. The backward are catching up with the more advanced.

European colonizers who discovered Australia inhabited by people of the Stone Age did not understand that the present of Polynesia was the past of Europe.



CHAPTER V

A STRUGGLE BETWEEN WORLDS

Two Codes of Laws

Sailing about the seas in their ships, men have several times discovered not only new countries but also long forgotten times.

When Europeans discovered Australia it was a great piece of luck for them—to discover and take possession of a whole continent.

But for the Australians it was an unmitigated misfortune. You see, the Australians were living in another era, according to the labour calendar. They did not want to submit to European ways. And for this the Europeans tracked them down and hunted them like wild beasts.

The Australians still lived in huts, while in Europe there were tall buildings in their cities. The Australians did not yet know anything about private property, while in Europe people were thrown into jail for killing a deer in a forest belonging to someone else.

What was lawful for an Australian was a crime for a European. When Australian hunters came on a band of sheep, they surrounded them with whoops of joy, hurled their spears and boomerangs at the terrified animals from all sides. But then the European farmers and their carbines went into action.

For a stock-raising European a sheep was private property. For a primitive Australian hunter it was a lucky find. "A sheep belongs to the one who has bought him or raised him." That was European law. "A wild animal belongs to the hunter who has tracked him down." That was Australian law.

And because the Australians obeyed the law of their era, the Europeans not understanding shot them down as if they were wolves who had broken into the sheep fold, instead of human beings.

The two codes of laws clashed also when the native women happened to find a potato patch. Without a moment's hesitation, they began to dig up the wonderful tubers with their sticks. It was a big thing to find so many edible tubers and all in one place, too! They could get more here in an hour than they usually got in a whole month.

But their good luck turned out to be a great misfortune for them. There was a thunder of gunshots and the women fell to the ground with their sacks of potatoes, not knowing who had killed them or why.

There was the same kind of struggle between two worlds when America was settled.

Discovery of America

When Europeans discovered America, they thought they had found a new world. Columbus was given a coat of arms with the device: "For Castille and Leon Columbus discovered a New World."

But, in reality, this New World was an old world. Europeans, without knowing it, had discovered their own long forgotten past in America.

To these newcomers from across the ocean, the customs of the Indians seemed savage and incomprehensible. Indians didn't have the same kind of houses as Europeans, they didn't wear the same kind of clothes or have the same ways.

Those Indians who lived in the North made their clubs and arrowheads of stone and bone. They had never heard of iron. They were already familiar with agriculture—they sowed corn (maize), grew pumpkins and beans and tobacco in garden patches. But their main occupation was hunting. They lived in wooden houses and built high stockades around their villages.

Further south, in Mexico, the Indians had ornaments made of copper and gold. They had large houses built of adobe, plastered with gypsum.

The earliest colonists and conquerors of America tell us about all these things in great detail in their journals. But it is easier to describe possessions than manners and customs. In America, the manners and customs were so strange that Europeans didn't understand them at all, and they

tell about them in the vaguest and most confused way.

Great areas of the New World were a world without money, without traders, without rich and poor. There were tribes among the Indians who knew about gold, but they did not know its value.

Some of the first Indians whom the sailors with Columbus saw, had gold ornaments in their noses and wore gold necklaces, but they gladly exchanged them for glass beads, trinkets, and bits of cloth.

The newcomers from over seas were used to thinking that all the people in the world were divided into masters and slaves, landlords and serfs.

When the Indians captured an enemy, they did not make a slave or a servant of him. They either killed him or adopted him.

Here there were no private castles or estates. Among the Iroquois, for instance, people lived in communal homes which they called "long houses." Whole clans lived and worked together. The land did not belong to separate individuals but to the whole tribe. Here there were no serfs who worked another man's land, but all were free.

This alone was enough to dumbfound the Europeans who lived in feudal times, in the time of lords and serfs, but this was not all.

In Europe everyone knew that if he took property belonging to another person, a policeman would grab him by the collar and hustle him off to jail, while here there were no such things as policemen or jails. Yet there was public order and

the people kept this order, but not as they did in Europe.

Here in America a man was protected by his kinsmen and fellow tribesmen. If a person was murdered, the whole clan avenged the murder. And there were cases where such an incident was settled peacefully. The kinsmen of the murderer would ask pardon and make presents to the kinsmen of the murdered man.

In Europe there were emperors, kings, princes. In America there were no kings. The affairs of the tribe were decided by a council of leaders in the presence of the whole tribe. Leaders were chosen for services rendered and removed if they did their work badly. The leader was not a lord over his fellow tribesmen. The very word "leader" meant "orator" in some of the tribal languages.

In the Old World the king was the head of the Government, the father was the head of the family. The largest organization of society was the state, the smallest the family. The king sat in judgment and meted out punishment to his subjects. The king left his country to his son, a father left his estate to his son.

Here in the New World were tribes with other customs. In some tribes a father had no power over his children. Children belonged to the mother. Women directed everything in the "long houses." In European families sons stayed at home and daughters flew from the nest in every direction. Here, on the contrary, it was not the husband who brought his wife home with him, the

wife brought her husband home with her. Women were mistresses of the home.

We find the following description in the account of a traveller in the New World:

"It is the custom for women to direct the home and this keeps them, naturally, closely united. Stores of supplies are common property. But woe to the husband who is a poor provider and doesn't bring in much booty! No matter how many children or how many possessions he has in the home, he may at any moment be ordered to roll up his blankets and be off. It wouldn't do any good to defy the order. It would be too hot for him in the house. And unless some aunt or grandmother came to his rescue, he would have to go back to his own tribe or marry into some other tribe. Women have great power. They do not hesitate when necessary to 'knock the horns off' the head of a leader, as their expression is, to reduce him to the rank of a simple warrior. So the selection of a leader always rests entirely with them."

In the Old World women were in subjection to men. Among these Indians, woman was the head of the home, sometimes even the head of the entire tribe. Puskhin, the Russian writer, tells a story about how the American John Tanner fell in with Indians and was adopted by a woman named Nyet-No-Kua who was chief of the Ottawas. Her boat carried a flag, and when Nyet-No-Kua arrived at an English port, she was always met with a salute of cannons. White men as well as Indians had a high respect for her.

No wonder that under such conditions people reckoned their line of descent through the mother instead of through the father. In Europe children took the name of the father. Here they took the tribal name of their mother. If the father's tribe was called "Deer" and the mother's "Bear," the children belonged to the "Bear" tribe. Every tribe was composed of women, their children, the children of their daughters, and the children of their grand-daughters.

Europeans couldn't understand this at all. They called the customs of the Indians "savage" and the Indians themselves "savages."

They forgot that they used to have the same customs in the days of the bow and arrow, of the first canoe and first hoe.

In their notes about America, the early colonists and conquerors pictured the tribal leaders as princes and lords. They regarded the word "leader" as a title, the totem pole as a coat of arms. They interpreted the council of leaders as a senate, and thought the chief leader was a king, just as if we should today call the commander of an army, king.

For several centuries the white inhabitants of America failed to understand the customs of the indigenous population. This was so until an American anthropologist, Morgan, discovered America for the second time in his book "Ancient Society." Morgan was the man who showed that the tribal organization of the Iroquois and the Aztecs was a stage that had been passed in Europe long ago.

But Morgan did not write his book until 1877 and we are talking about the first conquerors of America.

The white men did not understand the Indians and the Indians did not understand the whites. The Indians could not understand why white men were willing to tear each other to pieces for a handful of gold. They did not understand why white men had come to America, or what the "conquest of a foreign land" meant.

According to the beliefs of primitive peoples, the land belonged to the whole tribe and was protected by the protecting spirits of the tribe. To take by force land belonging to others brought down on one's head the wrath of the gods of those other people.

Indians made war, but when they conquered a neighbouring tribe they did not enslave it, or impose their way of life on it. Nor did they remove the leader, but made the conquered pay a ransom to get him back. A leader could be removed only by his own clan or his own tribe.

So two worlds, two ways of life clashed. The history of the conquest of America is the history of the struggle between two worlds.

A good example of this struggle is the conquest of Mexico by the Spanish.

A Chain of Errors

In 1519 a fleet appeared off the coast of Mexico —eleven three-masted vessels. The ships bellied out at the sides, their prows and poops rose high

above the water. Cannon looked out from the square hatchways, lances and military muskets bristled on the decks. At the prow of the flagship stood a bearded, broad-shouldered man wearing a beret pulled low over his eyes. His sharp eyes took in the low-lying coast and the crowd of half naked Indians who had gathered on the beach.

The name of this man in the flagship was Hernando Cortez. He was the commander of the expedition, sent out to conquer Mexico. True, there was a letter in his pocket in which the Spanish government removed him from command. But what was an order of dismissal for such a reckless adventurer as Cortez! An endless stretch of water lay between him and Spain. Here, on these ships, he felt himself king.

The ships stood at anchor. The Indian slaves whom Cortez had captured in the islands along the way began to unload the heavy-bored cannon, gun carriages, and bundles of muskets into rowboats. They brought up on deck, horses rearing in fright. The hardest job of all was to get them off the boats and onto the shore.

The Indians looked with amazement at the floating houses, at the pale skinned men who covered their bodies all over with clothing, at their strange weapons. But what amazed them most were the big, whinnying animals with their tossing manes and tails. Never before had they beheld such monsters.

The news of the arrival of white men spread rapidly along the coast and far into the interior of

the country, into the mountains. There, in a valley behind a wall of mountains, the Aztecs lived in their pueblo towns. The biggest of these was Tenochtitlan. It stood in the middle of a lake and was connected with the shore by bridges. The gleaming white walls of its houses and the gold roofs of its temples were visible from afar. In the largest of the houses lived the military leader of the Aztecs, Montezuma, with his whole clan.

When Montezuma heard of the arrival of the whites, he called a council of leaders. They thought for a long time about what they should do. The main thing was to find out why the whites had come, what they wanted.

From rumours which had reached them from other places, they knew that white men loved gold, so the council decided to send rich gifts to them and ask them to go back to their own country.

This was an irretrievable mistake, for gold would only whet the greed of the whites. But the Aztecs did not, could not know that, for the Indians and the whites were living in different eras.

The messengers were sent on their way. They took along rings of gold as large as a wagon wheel, golden ornaments, golden figures of people and animals. They would have been wiser if they had buried all these treasures deep in the ground!

When Cortez and his companions saw the gold, the fate of the Aztecs was sealed. In vain the messengers begged him to go away beyond the sea, in vain they tried to frighten the uninvited guests

by telling them of the hardships and dangers of the trip into the mountains.

Formerly the Spanish had known of the Mexican gold only by hearsay, now they saw it with their own eyes. Their eyes glittered. The stories were true then.

The requests of the ambassadors seemed ridiculous to them. Go back across the ocean when the goal was so near! That would be sheer madness.

How many hardships they had suffered on the way. The dry hardtack which almost broke their teeth, the hard hammocks in the crowded holds, the hard work up among the tarred rigging, the storms and reefs—they had endured all these things for the sake of the riches they dreamed of at night.

Cortez gave the order to break camp and set out. His men loaded weapons and provisions onto the backs of the slaves. The slaves, more like beasts of burden than human beings, trudged along, groaning under their loads. They had to keep going, for if any lagged behind, the Spanish prodded them with their swords, and cracked the skulls of any who refused to go on.

A drawing made at that time has been preserved in which the Aztecs themselves pictured this expedition. In this drawing, people with bundles on their backs are walking along on three roads. One has the wheel of a cannon carriage on his back, another a bundle of muskets, a third a box packed full of supplies. A Spanish officer is holding a club over the head of an Indian. He had grabbed

the Indian by the hair and is kicking him. Alongside is a cliff with a crucifix on it.

The conquerors considered themselves "good Christians." They took the cross along when they set out to conquer a country.

In this drawing there are decapitated heads and slashed off hands lying all about on the ground.

Step by step, the Spanish went on and, finally, from a mountain pass, they caught sight of the lake and the towns in the middle of it.

The Aztecs did not offer any resistance. The "guests" walked into the city, and the first thing they did was far from polite. They seized the man whom they regarded as the ruler of the city, the military commander, Montezuma.

Cortez ordered Montezuma put in chains and demanded that he swear allegiance to the Spanish king. The captive submissively repeated everything they ordered him to say but he hadn't the slightest idea what they meant by a king or what an oath was.

Cortez considered the victory won. He thought that he had captured the king of the Mexicans and the captured king had handed over his authority to the king of Spain. That is, everything was settled. That's the way Cortez reasoned. But he reckoned without his host. He knew as little about the Mexican ways as Montezuma did about the Spanish. He thought Montezuma was a king, but he was only a military leader and had no power to dispose of his country.

Cortez was counting his eggs before they were hatched when he thought the victory was in his hands.

The Aztecs did what he least expected; they elected a new leader, Montezuma's brother.

The new leader summoned all the warriors of the tribe to storm the big house where the Spanish had settled themselves.

The Spanish fired their cannon and muskets. The Aztecs hurled stones and shot arrows from their bows. Cannon balls and bullets are more powerful than arrow and stones but the Aztecs were fighting for their freedom and nothing could stop them. When dozens fell, hundreds took their places. They were brothers fighting to avenge their brothers, tribesmen fighting to avenge their fellow tribesmen. His own life meant nothing to an Aztec when his clan was in danger, and with his clan his whole tribe.

Cortez, seeing things were going badly, decided to enter into a parley with the Aztecs. He thought the best thing to do was to use Montezuma as a go between. Montezuma was their king. Let him order his people to lay down their arms.

They took off Montezuma's chains and had him go up on the roof of the house, but the people looked on him as a coward and a traitor. He was greeted by a shower of stones and arrows. From all sides came shouts of "You good-for-nothing! You're not a warrior! You're a woman, fit to spin and weave, to let those dogs keep you a prisoner! You coward!"

Montezuma fell seriously wounded.

Cortez had a hard time getting out through the ranks of the besiegers. Half of his soldiers were killed. Fortunately for him, the Aztecs did not pursue him or he would never have gotten off alive.

The Aztecs made another mistake when they let Cortez escape. He collected another army, came back and laid siege to Tenochtitlan. The Aztecs defended themselves for a few months, but what can bows and arrows do against cannon! Tenochtitlan was captured and sacked.

Men of the Iron Age conquered men of the Bronze Age. The old clan system gave way under the attack of a newer order. History itself was fighting on the side of Cortez.

The few remaining descendants of those free mountain warriors work together on the plantations of their home-owners.

CHAPTER VI

LIVING TOOLS

Thousand League Boots

A writer of the last century tells a story about a man who happened to buy a pair of thousand league boots, instead of an ordinary pair.

The hero of the tale was an absent-minded fellow and didn't discover his mistake right away. He started home from the market, thinking hard about something, when suddenly he began to feel very cold. He looked around and saw ice everywhere, and a dull red sun low on the horizon. It turned out that the thousand league boots had taken him to the Arctic without his noticing it.

Anybody else in his place would have tried to make as much as he could out of the miraculous piece of luck. But the hero of the story didn't care at all about money. His main interest was science, so he decided to take advantage of his good luck to see and study the whole globe.

He started travelling all over the earth in his thousand league boots—from the North to the

South, from the South to the North. Sometimes winter drove him from the frozen wastes of Siberia to the deserts of Africa. Night forced him to go from the eastern half of the globe to the western.

In a worn black coat, with a box under his arm for his collections, he crossed from Australia to Asia and from Asia to America, using islands as stepping stones.

Carefully stepping from peak to peak, now through fire-breathing volcanoes, now over snow-covered mountains, he collected minerals and grasses, looked at ancient temples and caves, studied the world and everything in the world.

We, too, reader, have had to put on thousand league boots in order to study the life of man. On the pages of this book we have stepped from continent to continent, passed from one era to another.

Sometimes the enormous stretches of time and space have made our heads swim, but we didn't stop. We couldn't stop and study details as people in ordinary boots do.

Perhaps we did glimpse a thing or two as we leapt through a century at one jump, but if we had taken off the thousand league boots even for a minute and taken an ordinary step we'd never have gotten out of the mass of details. When you examine every tree in a forest, you run the risk of not seeing the forest for the trees.

In our thousand league boots we have passed not only from age to age, but from science to science.

We've gone from the sciences of plants and animals, to the science of language, to the history of tools, to the history of religions, to the history of nations.

This was naturally not an easy thing to do, but we couldn't escape it. All the sciences have been created by man and for man, and they are all necessary when we're talking not merely about the shape of the petals of a little flower or the classification of the axes of the Bronze Age, but about the life of man on the earth and his place in the world.

We have just been in America at the time of Cortez.

Now let us go back to Europe in the third or fourth century of our era. We shall find there the same clan system the Iroquois and Aztecs had. We shall find communal "long houses" in which women hold sway.

They look up to the woman in the home, for she is both home builder and the head of the clan. She looks after the stores for winter, digs up the ground for planting, and gets in the crops.

She works more than the man and for that reason is thought of more highly. In those days you would find in every village, in every household, an image of woman, the mother, carved of bone or stone. This was the ancestral mother from whom the clan descended. Her spirit protected the house. They prayed to her to send them bread, to protect their house from its enemies.

After a time this maternal protectress of the home became Athena, a goddess armed with a spear,

protectress of the city. And she was not represented by a little figurine, but an enormous statue of the goddess guards the city which bears her name.

A Crack Appears in the Old Structure

Our language still retains some traces of the clan system, but we don't remember anything about it.

Grown-ups sometimes say "Brother" instead of "Friend," and in talking to a strange child we call him "son."

In German the word for "nephews" means "sister's children." That's because in olden times a sister's children stayed in the clan, while a brother's children belonged to another clan, the clan of his wife. A sister's children were relatives, "nephews," but a brother's children were not considered relatives since they belonged to another clan.

Evidently the clan system was a very powerful thing, if, in spite of ourselves, we still recall it. What broke it up?

In America, it was the coming of European conquerors that broke it up. In Europe, thousands of years before the discovery of America, it went to pieces of itself, like a house eaten by termites.

It began by men taking the business of the household more and more into their hands.

From time immemorial women had done the digging, and men had pastured the flocks. While there were only a few cattle, woman's work, agriculture, was the most important occupation. They ate meat rarely, and there wasn't enough milk for

everybody. If it hadn't been for the grain gathered by the women, there wouldn't have been enough to eat in the house. A little oaten loaf or a handful of dried grain was often all they had for dinner in those times. With this they had wild honey or wild fruits, again gathered by the women. Women managed the household and therefore had charge of everything.

But this was not the case always and in all places. Grain didn't do well on the plains. The prairie grass crowded out the grain. Its tough roots clung to the ground and when people tried to hoe it, they had to deal with hard turf and hardpan instead of crumbly soil, and they found difficulty in cultivating it.

Two or three women would take hold of the hoe together and even then, they could only scratch the surface. Seed thrown in these shallow furrows was dried by the sun and eaten by birds. The grain came up but it was sparse and skimpy looking. A dry spell would come along, too, and burn up the grain, leaving the native grass, which was used to dryness, unharmed.

When harvest time came there was nothing to harvest. You couldn't see the heads of grain among the weeds. Prairie grass again billowed in the wind like the flags of a hostile army which had been driven off but had come back again.

Wild grass in place of grain! Was it worthwhile to toil so laboriously for that?

But prairie grass was for animals what grain was for men. Cattle and sheep lived well on the

prairies! They found good grazing everywhere and every year the herd increased in size. With his knife stuck in his belt, man followed the cattle. That faithful friend of the shepherd, the dog, helped him herd his sheep so they wouldn't scatter over the prairies. The flock grew and gave more and more milk and butter and wool.

Grain was scarce in the home, but there was plenty of sheep's cheese and tasty goat's meat boiling in the cooking kettles.

Man's work, herding, was the most important work in life on the plains.

An ancient drawing of a ploughman was discovered on a cliff in Switzerland. It is crude and clumsy, and the ploughman looks like those funny men children draw. But it's not important to us whether the drawing is well done for to us, it is not a drawing but a witness. And this witness tells us plainly that the ploughman is following a wooden plough drawn by oxen.

This is the very first plough in the history of the human race. It is very like a hoe. The only difference is that there is a long pole attached to it, a kind of wagon tongue, and that bullocks, not people, are pulling the plough.

Man had discovered the first locomotive. For a bullock harnessed to a plough is a living motor, the living grandfather of our metal tractor. When man put a yoke on a bullock, he also loaded his work onto the bullock. Cattle, which formerly gave man only their meat, milk, and hides, now began to give him their labour power too.

The bullocks went into the fields with the yoke on their necks, and dragged the plough after them. The plough cut deeper into the soil than the hoe. The furrowed earth lay like a long black ribbon behind it.

The first ploughman leaned on the plough handles with all his might. Now he set the bullock to work for him. He made it plough and thresh and haul in the grain. In the fall he drove it onto the threshing floor and it trampled the grain out of the ears. Then he harnessed it to a heavy sled and it hauled the bags of grain in from the field.

Cattle raising aided agriculture. Man, the shepherd, became also a ploughman, and this gave him more authority in the home.

True, there was plenty of work left for the woman. She had to spin and weave, harvest the grain and look after the children. But she wasn't the head as she had been formerly. Both in the pasture and in the field, man took first place.

Men were not scolded so often about the house. On the contrary, they began to be the ones to do the scolding; they moved over from the defensive to the aggressive. Formerly it was nothing for the mothers-in-law, the aunts, and the grandmothers to chase a strange man out of the house. Now they courted him, for this outsider, coming from another clan, worked for all of them and fed the clan. And the clan began to hate to part with their men.

So the old order of things began to crack up, like an old oak which has stood for a hundred years.

A bullock harnessed to a plough is a living motor

People began to break old precedents more and more frequently. Formerly the wife brought her husband to her home, now the husband began to take the wife to his home.

This was a violation of an old custom, so they regarded the man who did it as a culprit. The bridegroom couldn't merely escort his wife home with him, he had to steal her, to get her by force and fraud.

On a dark night, the bridegroom and his relatives, armed with spears and daggers, would creep up to the house of the bride the groom's clan had selected from him. The barking dogs wakened everyone in the house. All the men, from gray haired grandfathers to beardless young brothers of the bride, seized their weapons. The wailing of the women drowned out the defiant shouts of the men. But finally successful and carrying his struggling bride in his arms, the bridegroom would retreat, guarded by his fellow tribesmen.

Years passed. What was at first a violation of a custom, gradually became itself the custom. The fight between the bridegroom and his wife's relatives became a ceremony. Gifts took the place of the bloody fighting. The lamentation of the bride's mother and sisters became part of the wedding ceremony which ended with a feast.

The old plaintive songs, in which the young girl bewailed her fate at having to go into another clan, are preserved to this day.

And it was not a fate to be envied. In her new home, the woman was under the domination of her

husband. There was no one to whom she could turn for sympathy, for her father-in-law and mother-in-law and all her husband's relatives were on his side. They looked on the bride as an additional woman servant in the house, and all saw to it that she earned her keep and did not sit about doing nothing. The matriarchal clan was superseded by the patriarchal.

Children no longer stayed with their mothers, but with their fathers. And descent was reckoned from the father instead of from the mother. In addition to the personal and clan name, a man now had a third name, "Son of So-and-So."

There is still a custom, dating from that period, of calling people by their father's name, by their patronymic, for example: "Peter Robertson" or, as they used to say in ancient times. "Peter the son of Robert."

No one would ever think of calling a person by the name of his mother: "Peter Helenson."

The First Nomads

The magic store-house man had discovered kept giving him more and more provisions all the time. Thousands of sheep fed on the plains and prairies. In the fields, ploughmen yelled at their lagging oxen, urging them on through the rich black soil.

In fertile valleys the first gardens and vineyards were blooming and bearing fruit. In the evenings people gathered under the shadow of fig trees.

Work gave man more and more food all the time, but he had to work harder, too. Every bunch

of grapes, every head of wheat, was soaked with human toil as with sap.

How much work there was with the grapes, for example! After they had brought in the heavy bunches, they were thrown into a stone mill and squeezed. The blood red juice dropped into a goat's skin bottle. People sang hymns in praise of wine, hymns about a beautiful god, dressed in goat skins, and what sufferings he had endured.

In river lowlands which were flooded every spring and fertilized by the sediment carried by the floods, nature itself, as it were, took care of the crops.

But even here the hands of the farmer had no rest. He dug canals to keep the water in the fields and threw up dikes to force the water to the spots where it was most needed.

People prayed to the river, which gave their land fertility, oblivious to the fact that without their own toil on the land it would have produced only weedy wild grass.

The farmer's work was getting harder all the time, but the cattle raiser was not having an easy time of it, either. On the lush prairies the flocks increased by leaps and bounds, and the bigger the flock, the more work it made. It is one thing to look after a dozen or so sheep, but quite another to look after thousands of them. Then a big flock soon cleaned up a pasture and men had to drive them to other pasture, farther and farther from the home.

The whole village would take up their belongings and follow after the flocks

Finally, it got so that the whole village would take up their belongings and follow after the flocks. They loaded their tents on camels and set out, driving their flocks before them.

They left behind deserted fields overgrown with weeds. But they didn't let that worry them, for good crops were a rarity on the dry plains.

For the first time, division of labour, not merely between individuals but between tribes, came into existence.

On the plains were shepherd tribes who raised cattle and exchanged them for grain. They did not stay in any fixed place but migrated, moving from pasture to pasture. The life of these nomads was wild and free.

They pitched their tents under the open sky where there were no trees or houses to shut it out. The whole wide plain was their home. On their long treks, the swaying back of the camel served as a cradle for their babes.

Living Tools

The life of nomad tribes was not a quiet and peaceful one. When they came to fields and flocks on their march, they often reaped what they had not sowed. As they ranged down the mountain slopes into the river valleys or skirted the edge of the forest along the plains, they plundered villages, trampled down growing grain and carried off livestock and people.

They needed people most of all, for they could put people to work for them herding the flocks.

There was always a shortage of workers in the tribe. Each man might have ten or more sons, but still there were not enough workers. The flocks grew so rapidly that there never were enough herders, so the tribe captured members of other tribes and made slaves of them.

That was what the nomad cattle raising tribes did. But the farmers were not any too peaceful either. In the autumn, after the harvest, they didn't hesitate to make a raid on their neighbours to steal their stores of grain, cloth, ornaments, and weapons. But the booty they prized most was the tribesmen themselves.

For farmers were short of hands, too, to dig their canals, build dikes, and drive the bullocks at ploughing time.

In the earlier times they didn't make slaves of their prisoners because there wouldn't have been any sense in it. An extra pair of hands didn't bring in extra income. The man would work, but he would also eat all he produced.

The whole situation was changed when they began to have big flocks and fertile fields. The work of one man began to produce more grain, meat and wool than he needed for himself. A captive could feed both himself and his master by his work. All the master had to do was to see to it that his slave worked more and ate less.

So man made a living tool for himself of his fellow man. He degraded man, put a yoke on him as he did on the ox. On the way toward freedom,

toward the conquest of nature, man became the slave of his fellow man.

Formerly land was common property, belonging to all who worked it. Now a slave began to till soil which did not belong to him. The ox he drove was not his ox and the crop he harvested was not his crop.

A slave in ancient Egypt sang as he drove the oxen:

Trample the ears of grain, oxen !
Trample the ears of grain.
The crop belongs to the master !

Memory and Monuments

Our journey into the past has, so far, been full of difficulties. We have lost ourselves in the labyrinth of caves. We have gotten stuck in the ditches and pits of excavations. Everything we found was a riddle we had to guess. We haven't seen any signs on our way, or any inscriptions carvedon pillars to help us in our search. How could men of the Stone Age leave us anything in the shape of an inscription when they couldn't write!

But now, at last, we have reached a road that has signs along the way. We find the first inscriptions on tombstones and on the walls of temples. These are not at all like those old magic drawings intended for spirits. They are whole stories in picture, stories for people and about people.

There is still nothing at all like our letters. An ox is represented by a picture of an ox, a tree is pictured with all its branches.

The history of writing begins with picture writing. It was a long time before these pictures were simplified and became conventional symbols.

When we look at the letters of our alphabet, it is hard to guess from what picture they have come. Who would imagine that "A" is the head of an ox ? But if you turn "A" upside down, you will have a head with horns on it. In the alphabet of the ancient Semites this horned head meant "A," the first letter of the word "Aleph" meaning "ox."

You can trace the history of every one of our letters in the same way. "O" is an "eye," "R" is a head on top of a long neck.....

But our thousand league boots have carried us too far ahead. We have come down, in our story, only to the time the first picture writing appears.

Man learned to write slowly and gropingly.

So long as there wasn't much to know people could easily keep it all in their memories. Traditions, legends, and tales were handed down by word of mouth. Every old person was a living book. Remembering word for word the tales, legends, rules for correct living, people handed them down to their children as a precious legacy and they, in turn, handed them on their children,

But now monuments come to the aid of memory. Written language begins to help spoken language hand on man's experiences. On a leader's tombstone they made pictures of his exploits and battles so future generations might know about them. When they sent ambassadors to leaders of neighbouring tribes, they scratched some picture

writing on a bit of bark or a piece of broken crockery to help his memory.

The first book in the world was on a tombstone. The first letter was on a piece of bark.

We are proud of our telephones and radios and sound recording apparatus which helps us conquer space and time. We have learned to send human speech thousands and thousands of miles by radio. Our voices printed on ribbon and records will be heard decades and centuries from now. It is a great achievement, but we must not exaggerate our contribution.

Long, long ago, our ancestors first conquered space when they sent a message on a piece of bark, and time when they carved an inscription on a monument.

Many monuments have come down to us which speak eloquently of the exploits and battles of former days. Figures of the warriors with swords and spears are carved in the stone. The victors are returning home in triumph followed by their captives with heads drooping and arms tied behind their backs. And there among the pictures which represent words, we find the first chain handcuffs, the sign of subjugation, of slavery.

This sign tells us of a new chapter in the history of mankind—the beginning of slavery.

On the walls of Egyptian temples we find, later on, quite a number of such picture witnesses. In one a long line of slaves is hauling bricks for a building. One of them has a box of bricks on his shoulders and is holding it in place with both hands,

another is carrying bricks balanced at each end of a long pole over his shoulders, such as we use in carrying pails of water. Masons are laying the wall, and there sits the overseer on a piece of brick. He's resting his elbows on his knees and has a long stick in his hand. He doesn't have to work; his job is to make the others work. Another overseer is walking about near the building that is being put up. His stick is raised threateningly above the head of a slave. Evidently the slave has done something he didn't like.

About Slaves and Freemen

A rose does not grow from an onion, a free man is not born of a slave mother.

The Greek poet, Theognis, wrote those lines at a time when slavery was firmly established as the existing order of society.

In the earlier times, slaves were not regarded as being of an inferior race. Freemen and slaves lived together, worked together, forming one big commune. The father was the head and ruler of this family commune, the "patriarch." His sons and his sons' wives and children, the men and women slaves, lived under the same roof with him and were in subjection to him in everything. Only the father had the authority to "cane" both a disobedient son and a disobedient slave.

An old slave, when he addressed his master, called him simply "son" and the master, in turn, called the old slave "father," according to ancient custom.

If you have read the "Odyssey," you undoubtedly remember the old swineherd, Eumeus, who ate and drank at the same table with his master as a matter of course. The folk singers and minstrels, who composed the "Odyssey," called the swineherd "equal to the gods," just as they call the leader of a tribe.

But the poem is not exactly true to fact. The swineherd Eumeus was the equal neither of the gods nor of his master. He had to work, his master could work or not as he pleased. More was required of a slave in the household than of a member of the family, and he received less. A slave was property —a freeman was a property owner.

When his master died, a slave was handed on to the sons along with the cattle and other possessions.

The former equality no longer existed in this family commune. Here the father was the ruler of his children, a wife was in subjection to her husband, a daughter-in-law to her father-in-law, the younger daughters-in-law to the older ones. But lowest of all was the slave.

The former equality between tribes, between communes, no longer existed, either. Some had many cattle, others few. And cattle were valuable; they could be traded for cloth and weapons. It is no accident that the earliest coins were made in the shape of a spread ox hide.

But a slave was still more valuable. A slave took care of the pigs and cows and sheep. In the evening, he drove them into the cow sheds and sties and sheepfolds surrounded by a stout stockade.

A slave helped get in the crops, a slave squeezed the juice out of the grapes and the butter out of the cream. Great supplies of golden grain were stored in the granaries. Clay jars, amphorae, were full to the brim with sweet smelling oil.

The slave helped the freemen, but the hardest work always fell to the slave.

War became a profitable business, for war brought slaves, and slaves brought riches. So freemen went to war and left the slaves at home to look after the cattle and till the soil.

The Siege of a Fortress

War gave people still more work to do. They had to have swords and spears and war chariots for attack.

Two fleet horses harnessed to the war chariot, whirled them over the battlefield, but in war, attack is inseparable from defence. The warriors put helmets on their heads and carried shields on their left arms to protect them from the blows of their foe's swords and spears. They built strong walls of huge granite blocks around the communal dwellings. The richer and more powerful the clan, the harder they had to work to protect themselves, for they had something worth fighting for. Huge fortress-like dwellings rose on the high hills, with dozens of rooms and store-houses, with bastions along the walls, and stout gates.

From the walls of the fortress, the country was visible for miles around. When a cloud of dust and the glitter of spears appeared on the plains, the

people got ready to defend themselves inside the fortress. The ploughman drove his oxen in hurriedly, the shepherd herded his flock inside the walls. When the last person and animal were inside, the heavy gates were closed. Warriors on the walls and in the lookouts waited for the foe, ready to let fly at him with their winged arrows.

The besiegers came up to the fortress and pitched camps outside the walls. They knew that it was no easy thing to capture a stronghold, that many a month might pass before those high walls would crash.

Every morning the creaking gates of the fortress swung open. The defenders, a band of warriors protected by their spears, rushed out to decide the fate of the clan in the open plain. They hurled their swords fiercely against the foes' glittering helmets trimmed with horses' tails. They fought until they were exhausted, sparing neither themselves nor their enemies.

On one side they were inspired by the thought that they were defending their homes, their wives, and their children, while the others were fired by their desire for the rich booty, so hard to get. Late at night the defenders withdrew, under cover of darkness, leaving their dead on the field. The fighting quieted down until dawn.

Days go by. The besieged fight bravely against the besiegers, but hunger is more terrible than the swords and arrows of their foes.

When there is only dust left in the bins instead of grain, when the last trickle of oil coming out of

the amphora begins to break and is only a string of separate drops, then there is lamentation inside the fortress. The hungry children cry but the women wipe their tears away in secret for fear of calling down on themselves the wrath of the men.

After every raid there are fewer left inside to defend the fortress, and the day comes when the besiegers, pursuing the retreating defenders, break into the fortress. They tear down the high walls leaving not one stone standing on another. Where people had lived, worked, feasted, there are now only ruins and the corpses of the slain. The victors carry off men, women, and children to be slaves instead of freemen as before.

The Dead Tell About the Living

In many countries, on plains or on open stretches of level ground, there are long, low elevations. Sometimes there is only a single large mound; sometimes there are so many that they seem like a range of very low hills.

In many countries the inhabitants are not sure what these long mounds, which archaeologists call barrows, really are. Many stories and legends have become connected with them, as stories always cling to anything which is rather out of the ordinary, especially if they have been there much longer than even the oldest man can remember.

Let us question the archaeologists who are making excavations in the barrow for they have discovered what happened many centuries before they were born.

The barrows, they tell us, are the graves of people who lived on the plain long, long ago. As the excavators dig into the barrows, they find deep down in them skeletons of human beings and, with them, are clay vessels, implements of stone or bronze, and some horse bones.

This is what his friends gave the departed to take with him on his long journey. People believed that a person would have to eat and work after death, that a woman's spirit would need her spindle, a man's his spear.

In all the most ancient barrows some of the dead person's belongings are buried with him. But in the very early times, people didn't have many possessions. What did an individual have that he could call "his own?" An amulet which he wore around his neck, or the spear he used to run his foes through. Everything in the home was owned in common, for the home was run as the common affair of the whole clan. So in the most ancient barrows there are no rich graves and no poor ones. The dead were all equal.

Rich and poor appear at a later date among the dead.

On the river Don, they found a barrow with three kinds of graves. In the first were the rich, in the second the moderately well-to-do, in the third the poor.

In the middle of the biggest barrows they found a big pit, the grave, and in it were painted Greek vases, gold trimmed coats of mail, and daggers of artistic workmanship.

There were rarely any gold articles in the middle sized barrows, and never such a thing as a painted vase. The graves of the poor are not worth mentioning, for there wouldn't likely be lacquered bowls or elaborate coats of mail in a poor man's grave.

There are many more of the poor little mounds in the cemetery than of any of the others. In these little pits near the dead man's right hand lay a spear, near his left hand a mug to use if he should be thirsty. The poor remained poor even in the grave.

There's a saying "silent as the grave." But these graves didn't remain silent. They tell us very plainly about the times when rich and poor first appeared in the world. The dead tell us about the living.

If we leave the graves and go to the settlement not far from the barrows, we shall see there traces of former great riches and former poverty. Archaeologists have discovered that the village, situated on the bank of the river, had two walls; one ran around the outside of the village, the other enclosed a circle in the centre. In this central part they found many pieces of expensive utensils and vases which had been brought there from far away Greece. In the outside part, between the inner and the outer walls, there were hardly any such things found. These pieces of the most ordinary local pots and pitchers were lying about. The people who lived there had no reason to buy foreign dishes with figures painted on them, or shiny lacquered bowls.

Above the graves of these people rose later the high earthen embankments which still stand out against the skyline of the level land.

So graves tell us about the people buried in them. Sometimes they tell terrible things—about slaves who were killed so they might be buried with their master, and about women forced to follow their dead husbands into the grave. They tell more eloquently than any books, stories of the cruelty of a father, the head of a rich clan. When he died he took with him to the grave both his wives and his slaves, for they belonged to him just as the precious articles of gold and bronze belonged to him.

Man Creates a New Metal

The precious things that lay for thousands of years in the darkness of the graves and among the ruins of fortified settlements are now preserved in museums. Objects of the far distant past, hidden from man's gaze for so many years, are now exhibited for everyone to see and we may behold them with our own eyes.

Visitors stand for a long time before the glass cases in museums, looking at swords with gold hilts, twisted chains of the most delicate workmanship, beads made of golden calf's heads, and silver utensils in the shape of oxen or reindeer.

What work and what art were required to make every one of these things!

It took many days to make even the simplest bronze dagger. First they had to get the ore. The days when pieces of pure copper could be

found lying about were gone. They had to go deep down into the ground for copper ore, just as they did for flint. Down in the deep shafts of mines they broke it out with picks, then carried it up in leather bags.

To make it easier to get the ore out, they would light a bonfire in the mine and when the stone walls were heated, pour water on them. The water hissed and turned into clouds of steam, the stone cracked and broke into pieces. Fire helped the miner's pick.

A mine in those days looked like a volcano. From its mouth, as from a crater, rose clouds of steam, lighted up by the fire below. The word "volcano" comes from the name of the ancient blacksmith god, Vulcan.

After they got the ore, they smelted out the metal. This, too, required a great deal of skill. To make the metal hard andeasier to mould into the things they wanted to make, while smelting they added tin ore to the copper ore, which gave them an alloy of copper and tin. This was no longer pure copper—it was bronze, a new metal with new characteristics, created by the hands of man.

In the old days, in the time of rude stone implements, one worker could easily take the place of another. It was not very hard to master a craft. All the men were hunters in a hunting tribe, and every one of them could make his own bow and arrows.

But to turn a piece of ore into a shining bronze sword is a very different thing from bending a sapling and tying the ends together with a cord. Peo-

ple now had to spend years studying the art of making armour. Sons learned it from their fathers. Craftsmanship was the property of a clan, its hereditary wealth. Entire communities were sometimes composed of potters, or armament makers, or coppersmiths, and their fame spread far and wide.

Mine and Yours

At first every craftsman worked only for his own community, his own village, but as time went on, armourers and potters began to get in the way of exchanging their wares for grain, cloth, or things made by other craftsmen. The old clan system began to crack up.

Formerly everybody in a village was the equal of everyone else. Now one crack made a line of demarcation between a rich clan and a poor one, another drew a line of separation between craftsmen and agriculturalists.

As long as a craftsman worked for the whole community, the community fed him. People worked together and shared together what they produced. But when a craftsman exchanged his swords and pottery on the side, he was no longer willing to share the grain, or the cloth, or whatever it was he had received in exchange for his wares, with his fellow clansmen. He felt that he and his sons had earned this grain, or cloth, or whatever it was without any outside help.

People began to live in separate houses. Ruins of villages found in Greece, in Mycenae and Tiryns show this clearly.

The richest family would live behind strong walls at the top of a high hill. They had good reason to want to hide their wealth behind stone walls! There the military leader of the whole tribe lived with his sons and their wives and children. In the valley below, the poorest people, the farmers, lived in their little huts. On low lying hills in the suburbs were the homes of the craftsmen —armament makers, potters, coppersmiths.

In such a town as this, people no longer lived on terms of equality. The masses envied the wealth of the rich and powerful leader, and consequently treated him with the greatest respect. They believed that the gods themselves were on his side. Their priests taught them this, drumming it into their minds from earliest childhood.

The agricultural workers did not regard the craftsman or miner as a brother, either. A miner, they felt, must be some kind of a wizard; a smoke-blackened man who got copper down in an underground hole with fire spouting from its mouth. How could a person know what went on down there? How did he get his ore? Evidently someone showed him where to dig in the ground, helped him to get the ore and turn it, by some miracle, into copper or bronze. The miner must have some mysterious guardians down there and an ordinary person had better keep his distance.

That's the way people thought everywhere, not in Greece alone. Stories about blacksmith wizards have come down to us from the remotest antiquity. Words have survived in our language

which show how people used to feel about riches and poverty. They didn't understand what caused the distinction between the rich and the poor, and thought that the fate of a man was preordained by the gods; that the gods were on the side of the rich but gave the poor only misfortunes.

CHAPTER VII

THE WORLD EXPANDS

The Beginning of Science

Man used to think the whole world was just a fairy land. He couldn't understand anything or explaina nything. Every step, every wave of the hand might start up unknown forces which would bring good or bad luck.

People still had so little experience to draw on, that they weren't sure whether daylight would ever come again after night or spring after winter. They performed magic rites to help the sun rise.

In Egypt, Pharaoh was believed to have power over the sun. Every morning he made a tour of the temple to make sure the sun would get around his course that day, and the Egyptians had a special festival in the autumn called the "Sun's Staff." They thought the weak autumn sun needed a staff to help him go on with his journey.

But man kept on working and found out more and more about the world and the laws of nature all the time.

A primitive craftsman, as he polished and sharpened a stone, became acquainted with its characteristics through his own hands and his own eyes. He knew that stone was hard, that if he struck it a hard blow it would break into pieces, and that it would not cry out when it was struck. True, there were all kinds of stones. This stone didn't talk, but maybe you might pick up another any day that would. We laugh at such an idea, but primitive man did not think as we do.

Primitive man had not yet learned to deduce rules so, for him, life was full of exceptions. He saw that no two stones were exactly alike, and he thought they might behave differently, too. When he made a new hoe, he tried to make it exactly like the old one, so it would dig the ground up well.

But years went by, thousands of years. Little by little man learned to understand the nature of stone in general, from handling many of all kinds. All stones were hard; that is, stone is a hard substance. No stone talked; that is, stones do not talk.

So the first germs of science, the understanding of things, appeared.

When a craftsman said that flint was a hard stone, he now meant all flint, not merely the piece he was holding in his hands. He came to know a certain law of nature, a certain rule existing in the world.

"After winter comes the spring." This doesn't surprise us in the least. It goes without saying that spring, not autumn, follows winter. But the sequence of seasons was one of the earliest scientific

discoveries made by our ancestors, a discovery they made only after long observation. People began to reckon in years only after they learned that the alternation of winter and summer is not an accidental thing, that spring always comes after winter, summer and autumn after spring.

In Egypt people made this discovery by observing the overflowing of the river Nile. They reckoned their year from one overflow to the next. The observations of the river were made by priests, for people thought the river was a god. There are still marks on Egyptian temples standing on the river bank, made by the priests to show how high the water came.

In July, when the fields were parched with heat, the farmers waited impatiently for the rising of the muddy, yellow water of the Nile. Would it really come? What if the gods were angry with them and refused to send water for their fields?

Gifts and offerings poured into the temples from all sides. Farmers brought their last handfuls of grain and gave it to the priests, humbly begging them to pray to the gods for them.

Every morning at dawn the priests went down to the river to see if the water was coming. Every evening they went up to the flat roof of the temple and, kneeling down, looked up to the stars. The starry sky was their calendar.

Finally, they would solemnly announce in the temple, "The gods have graciously listened to our prayer; in three nights the water will come to water the fields."

Slowly, step by step, people mastered what was for them, the new world; a world which could be understood, instead of a fairy world. The first astronomical observatory was the roof of a temple. The workshops of potters and smiths were the first laboratories where the first scientific experiments were carried out.

People learned to observe, to count, to draw conclusions.

This early science was very different from present-day science. It was still very like magic because it was hard to draw the line between science and magic. People not only observed the stars, they made predictions by them. At the same time they were studying the sky and the earth, they were also praying to them. Nevertheless, light was beginning gradually to break through their darkness.

The Gods Withdraw to Olympus

Once primitive man believed that there were spirits everywhere—in every stone, in every tree, in every animal, but slowly this belief came to an end.

Man ceased to think there was a spirit in every animal. A woodland god who lived in the forest was substituted for all the various animal spirits. Farmers ceased to believe there was a spirit in every ear of grain. For all these spirits they substituted a goddess of fertility who made the ears of grain grow.

These gods who took the place of the earlier spirits no longer lived among mortals. Knowledge

kept gradually crowding them farther and farther away from human habitations. The gods were moved to places where as yet no person had ever been; into the dark depths of sacred woods and up to the wooded tops of mountains.

But man went there too. Knowledge lighted up the forest jungles, and chased away the clouds that lay on the mountainsides. So the gods, driven out of their new asylum, moved up to the sky, and down to the bottom of the sea, or hid themselves in the bowels of the earth—in the underground kingdom.

There were tales, handed down by word of mouth, about how the gods came down to earth to take part in battles and sieges, armed with swords and spears. It was they who, at the last moment, concealed the hero in a dark cloud and struck down his foes with their thunderbolts. But, the story-tellers added, these things happened in the far distant past.

So man's experience extended farther and farther, the circle of light grew wider, forcing the gods to retreat from the immediate neighbourhood to a distance, from the present to the past, from this world to a world "on the other side."

It got hard to carry on business with the gods. Formerly anyone could perform ceremonies, carry out magic rites. They were quite simple. To bring on rain, for instance, all you had to do was to take some water into your mouth and squirt it out as you danced; to drive away clouds, you went up on the roof and blew in imitation of the

wind. Now people learned that they couldn't bring on rain or chase away clouds by such methods, so they came to the conclusion that it was not an easy matter to get the gods to grant one's wishes. It came about that a priest was used as a meditator between ordinary people and the gods; a priest who knew all the complicated ceremonies, all the mysterious legends about the gods.

Formerly a wizard was only a master of ceremonies, the director of a hunting dance. He was no nearer to the spirits than his fellow clansmen.

A priest was quite another thing. He lived in the sacred grove, next door to the gods. He went up on the roof of the temple to read the will of the gods in the book of the stars for he was the only one who could read this star book. Before a battle he examined the entrails of an animal and foretold victory or defeat.

The gods kept getting farther and farther away from mortals. Gone were those days when the gods treated everyone alike. As people looked at their own lives, they saw that their former equality was gone. "That's as it should be" the priests taught them. "Man must leave everything to the gods. The gods ruled the world, just as chiefs rule nations."

But not all the people meekly accepted the teachings of the priests. There were some who did not want to submit to the will of the gods.

The time is to come when a Greek poet will ask, "Where is the justice of Zeus? The good suffer, the unjust prosper. Children are punished

for the sins of their fathers. The only thing left is to pray to Hope, the only goddess who dwells among men. All the others have gone away to Olympus."

The World Expands

Primitive man made no distinction between truth and fiction, between knowledge and superstition.

Thousands and thousands of years had to pass before knowledge was freed from superstition, was precipitated out of superstition just as cream is precipitated out of milk.

In songs and tales that have come down to us, it is hard to distinguish the history of tribes and leaders from the fairy tale part about gods and heroes, hard to determine genuine geography from fictional, hard to tell the earliest observations of the stars from the old legends.

The Greeks have left us their old poems and legends in the "Iliad" and the "Odyssey." They tell us how the Greeks besieged and sacked the city of Troy and how later the leader of one of the Greek tribes, Ulysses (or Odysseus), wandered about over the seas for a long time before he succeeded at last in reaching his own city of Ithaca. Under the walls of Troy the gods fought side by side with men; some on the side of the besiegers, others on the side of the besieged. When death threatened a favourite of the gods, they spirited him away unharmed. As they feasted on the heights of Olympus, they discussed whether they should continue the war or reconcile the warring peoples.

Truth is mixed with fiction in these old tales. What is history in them and what fairy tale? Did the Greeks ever fight under the walls of Troy? And Troy itself—was there ever such a city?

This was a great point of dispute among scholars until finally an archaeologist stepped in to dispel all doubts. Following the directions in the Iliad, he went to Asia Minor and excavated the ruins of Troy in the very spot where it was purported to be.

It turned out, too, that not everything in the Odyssey was fiction. Geographers proved this. They were able to follow the wanderings of Ulysses. If you study a map, you will find on it the country of the Lotus Eaters, the island of Eolus, and even Scylla and Charybdis who almost wrecked Ulysses' ship when it was passing between them.

The country of the Lotus Eaters is the Tripolitan shore of Africa; Eolus is an island now called Liparski; and Scylla is a rock and Charybdis a whirlpool in the strait between Sicily and Italy.

Not everything in the Odyssey is fiction, but you'd make a great mistake if you took it into your head to learn the geography of the ancient world from it.

In this, the first book of travel, geography is all dressed up in fairy tales. Mountains are changed into monsters, savages living on islands into giant one-eyed cannibals.

People of those times knew only the places where they had been born and raised. True, there were merchants who sailed on the open sea, but they didn't venture very far from shore. It was a

perilous thing in those days to sail out into the open sea for people had no compasses or maps. They could only grope, setting their course by the sun and the stars. A high cliff on some island or a tall tree on the shore had to do duty as a lighthouse.

The sea concealed thousands of perils beneath its waters. The wide, bowl-shaped ships were tossed about by the slightest disturbance of the water; the clumsy sails were hard to manage. The wind would not obey man's orders and blew a ship about as if it were a feather.

And when a ship finally reached shore, the tired sailors had to drag it up onto the sandy beach. Here on the dry land they could rest at last, but they felt uneasy. A strange country was even more terrifying than the sea. The sailors imagined they saw the cannibals they had heard about from other sailors. They thought every new animal was some kind of dangerous monster. They were afraid to venture far inland.

Still every voyage did widen the world. The boundaries of the unknown, of the land of fairy tale, kept receding. The boldest sailors reached the gateway of the sea, beyond which lay the ocean. This ocean seemed to them as boundless as the universe. When they got back home, they said they had been to the end of the world and that the world was bounded on all sides by the ocean.

Thousands of years later people went from Europe to India, from China to Europe. Sailors crossed the ocean and found at the other side of it an in-

habited country. And yet the science of the earth will be accompanied by the fairy tale for a long time to come.

Columbus, the very man who discovered America, believed that there was a very high mountain in this country on which heaven rested. He wrote to the Queen of Spain that he hoped to visit these outskirts of heaven and explore the country round about.

People in Russia in the fifteenth century believed there were people living beyond the Ural mountains who slept all winter like bears. An old manuscript has come down to us entitled, "About the Strange People of the Eastern Country." In it there is a detailed account of people without mouths, headless people, and people with eyes in their chests.

This seems comical to us, but we also imagine that worlds inaccessible to us are peopled with monsters. We know the earth very well, so we have transferred our imaginary creatures to Mars and to the Moon.

The First Poets

With every age people got rid of more mysteries and wonders. The craftsman came more and more to believe in his own hands and his own eyes. He rarely had recourse to mystic incantations. Magic went out of life little by little, as darkness leaves a valley when the sun rises.

It held out longest in religious ceremonies, in sacred games, dances, and songs. But awakening reason relentlessly drove it out there too. The

magic went out of the dances and songs, leaving only the dances and songs themselves.

When the farmers in ancient Greece planned games in honour of Dionysus as the giver of fruits they were, at first, incantations. The chorus sang about the death and resurrection of Dionysus to help nature come to life again after the dead winter snow, and give people grain, fruit, and wine. Wearing animal masks, the farmers danced around the village altar. The leader of the chorus sang about the sufferings of Dionysus; the chorus, taking up the refrain, responded.

This ancient magic game was almost like a play. It is easy to see the future actor in the leader and in the maskers. The leader not only sings about the sufferings of the god, he also enacts them. He beats his breast, wails, and raises his hands to heaven. When the gods come to life again, the maskers go wild with joy, mimic each other, exchange gibes and jokes.

In the course of a few centuries, the magic disappeared from the magic game, but the game itself remained. As formerly, people play, sing, and dance, but they represent the sufferings of people, not of gods. Spectators, looking on, laugh and weep, are thrilled by heroic deeds, laugh at rascality and stupidity. The leader of the ancient chorus becomes the actor in a tragedy and the gay maskers are comedians, clowns and punchinellos.

But the leader is not only the first actor, he is the first poet. At first he sang only with the chorus. Later on he sang alone, too.

Songs are different from ceremonies. The soloist sings not only in the sacred games, he sings also at table when a chief feasts with his followers. As he sings, he plays on the strings of his harp, and even dances sometimes, uniting words, music and movement as was the old custom. He is both leader and chorus, singing the solo and the refrain.

What does he sing about? He sings about gods and heroes, about tribal chiefs who put brave men to flight, about warriors who fell in battle, about brother's vengeance for a brother.

This song was not an exorcism nor an incantation. It was a story about heroic deeds, an inspiration to imitate them.

But how about the songs of love, of spring, of grief? Where did they come from? They also sprang from ceremonies used at weddings and funerals, at the time of harvest or vintage. At these ceremonies the chorus sang short songs in turn. A girl as she sat at her spinning wheel, or a mother as she rocked her child, would repeat these little songs.

Who composed the first songs about heroes, the first songs about love?

We do not know. Just as we do not know who made the first sword or the first spinning wheel. Not one person, but hundreds of generations created implements, songs, words. A minstrel did not compose the songs he sang; he repeated what he had heard. As the song passed from minstrel to minstrel, it grew and changed. Just as a river

is made up of all the rivulets that run into it on its way, so poems grew out of songs.

We say that Homer wrote the "Iliad." But who was Homer? Only legends have come down to us about him. He is as legendary a figure as the heroes of whom he sings.

When the first songs about heroes were composed, the singer was still closely bound to his clan, to his tribe. People did everything together and their songs, too, were the composite work of generations. A minstrel did not consider himself the author or the creator, even when he changed and embellished the song that had been handed down to him.

But the time came when man began to distinguish between "his own" and "another's." The clan was breaking up; there was no longer the former unity. A craftsman worked for himself, he no longer regarded himself as merely an instrument in the hands of his clan.

A few centuries later the Greek lyric poet, Theognis, will say:

I have put my seal on these verses,
The fruit of my art.
No one shall steal them or claim them as his.
Everyone will say: These are the verses of Theognis of Megara.

No one could have said that in the time of the clan system.

Man more and more often uses the word "I." Those days when a man thought it was not he who

did his work, but someone working through him, were long past. A poet still speaks of the Muses who inspired him, sings about how he has received the "gift of song" from the gods, but he hasn't left himself out of the picture.

"*The Muses inspired me. I shall not be forgotten.*"

In this poem the Greek poetess, Sappho, combines the old with the new. She still believed that it was the Muses who told her what to say, not that she, herself, found the words on her tongue.

But in these lines there is heard the pride of the creator, the pride of the poet who knows that his name will not be forgotten.

So man grows. And the taller he gets, the wider becomes the horizon around him.